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# THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

"..... per Hecce spargite muscum,  
Naiades, et circum virescos consedite fontes:  
Follies virgineo teneros hinc carpitis flores:  
Floebus et plectum, diva, replete canistrum.  
At vos, o Nymphæ Craterides, ite sub undas  
Ite, reservato variata corallia truncis  
Vellitis muscosis e rupibus, et mihi conchas  
Ferte, Deæ pelagi, et pingui conchyliis succo."  
H. Partheni Oionotides, Æt. 1.

No. 49. JANUARY 1942.

## I.—On some East African Otiorrhynchinæ (Col., Curcul.).

By Sir GUY A. K. MARSHALL, F.R.S.

WHEN Lacordaire wrote his monumental classification of the Coleoptera, the weevils of East Africa were practically unknown. Since then a large number of new genera of Otiorrhynchinæ have been described from this area and fitted provisionally into Lacordaire's framework, but the results have not been altogether satisfactory and various adjustments will be necessary. Here an attempt is made to deal with only a portion of the tribe hitherto known as Oosomini, the number of genera in which has at least quadrupled.

Lacordaire's primary division of the Otiorrhynchinæ was based on the structure of the corbel of the hind tibie, this being either open or enclosed. With the relatively few genera at his disposal this worked quite satisfactorily; but now numerous species have been found in which this structure exhibits various intermediate forms, so that it becomes necessary to relegate it to a lower grade in the dichotomic series.

An examination of some hundreds of genera and thousands of species from all parts of the world has  
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revealed another character which may prove to be of considerable taxonomic importance, namely, the chaetotaxy of the mandibles. On this basis the Otiorrhynchinae fall fairly equally into two main groups. In one of these (which may be called the Trichætognathi) each mandible bears only three setæ, which are arranged in a regular sequence in relation to the mandibular scar: one in front, one at the side, and one behind it. In the second group (Polychætognathi) the mandible bears more or less numerous setæ (sometimes accompanied by scales) placed irregularly, though the number is rarely reduced to only four.

If these characters are applied to Lacordaire's system, they will be found to fit in very satisfactorily. In his arrangement the Otiorrhynchinae are placed between the Brachyderinae and the Eremninae, and it is interesting to note that the species of the former subfamily are entirely polychætognathous, while those of the Eremninae are consistently trichætognathous, so that the Otiorrhynchinae occupy an intermediate position between them. This suggests that possibly the mandibular chaetotaxy may be useful in an even wider scope, namely, as a primary division of the whole series of Curculionidae Adelognathi: but this will require much further investigation, though it may be observed that the Microcerinae and Leptopinae are all polychætognathous. It is also noteworthy that in the great series of Phanerognathi the vast majority of genera have the mandibles entirely devoid of setæ.

In Lacordaire's Otiorrhynchinae the tribes fall into the two groups as follows:—

Polychætognathi: Celeethetini, Otiorrhynchini, Laparocerini, Episomini, Eustylini.

Trichætognathi: Oosomini, Peritelini, Trachyphloeini, Phyllobiini (except *Phyllobius*, which like *Polydrusus* has multisetose mandibles).

#### OOSOMINI.

In his key to the tribes of Otiorrhynchinae, Lacordaire defined the present tribe as having the corbels of the hind tibiae enclosed, the tarsal claws connate, and the elytra without shoulders; but nevertheless he actually included in it two genera, *Pycoderes* and *Porpacus*, in

which the tarsal claws are free, and further, he misinterpreted this character in *Oosomus* and *Piezoderes*, in which the claws are also free.

It seems, therefore, desirable to separate these genera (for which the tribal name Oosomini must now be used) from those having connate claws, for which a new tribe is suggested below. The present tribe will also include *Chalepoderus* Mshl., 1923, and *Phlyctinus* Schönh., 1826, which latter must be excluded from the Otiorrhynchini on account of its trisetose mandibles. All these six genera are confined to the western side of South Africa (though *Phlyctinus callosus* Boh. has been carried by commerce to other countries), and several undescribed genera are also known to occur in the same area.

#### EMBRITHINI. trib. nov.

As just explained, this tribe includes all those genera hitherto placed in the Oosomini that have connate tarsal claws, and it may be divided into two groups—one having ten complete striae on the elytra, and the other twelve or more (sometimes very irregular) striae. The multistriate group appears at present to be confined to tropical Africa, extending across the continent: whereas the other group ranges from Abyssinia to the Cape, though none of the tropical genera has so far been found to occur in South Africa.

Owing to the present difficulty in obtaining access to necessary material, it is proposed to deal here only with the East African genera of the 10-striate group. It may be noted that the genus *Ceratocrates* Har., which most authors have included in this group, cannot be retained here because it has multisetose mandibles: von Harold quite correctly placed it in the Episomini.

The following key may serve provisionally as a means of distinguishing the East African genera of Embrithini that have ten striae on the elytra; but it must be noted that the genus *Mecomerinthus* Fst. is known to the writer from description only.

1 (32). Mentum bearing two setae.

2 (21). Epistome with its hind margin angulate and extending well behind front margin of scrobes (ill-defined in *Paraplecterus*, which has antennae entirely devoid of scales).

- 3 (4). Hind margin of eye raised above temple and more or less projecting angularly backwards (not visible when eye touches prothorax); corbels of hind tibiae squamose inside; scrobes lateral, hardly visible from above ..... *Simodes*, gen. nov.
- 4 (3). Hind margin of eye continuous with temple; corbels of hind tibiae bare inside; scrobes subdorsal or sub-lateral, distinctly visible from above.
- 5 (8). Rostrum with genae not or only very slightly dilated; scrobes sublateral, narrowly visible from above; mesosternum with a sharp median tubercle.
- 6 (7). Antennal scape very broad, strongly compressed; dorsal area of rostrum of equal width at base and apex; basal margin of elytra sinuate, with the lateral angles produced sharply forwards ..... *Leuroscapus*, gen. nov.
- 7 (6). Antennal scape not compressed, sub-cylindrical; dorsal area of rostrum narrower at base than between antennae; basal margin of elytra truncate, the angles not produced. .... *Epicasticus*, gen. nov.
- 8 (5). Rostrum with genae strongly dilated; scrobes subdorsal, broadly visible from above.
- 9 (10). Epistome very ill-defined; antennae without a trace of scaling ..... *Paraplesius* Hartm.
- 10 (9). Epistome sharply defined; antennae with at least the scape squamose.
- 11 (12). Mesosternum with a median tubercle; hind coxae reaching elytra; dorsal area of rostrum very broad and very shallowly sinuate laterally; head with a shallow transverse impression behind eyes ..... *Amphimetus* Klb.
- 12 (11). Mesosternum without a tubercle; hind coxae narrowly separated from elytra; dorsal area of rostrum much narrower, distinctly sinuate laterally; head not impressed behind eyes.
- 13 (20). Metepisternal suture obsolete behind.
- 14 (19). Rostrum without any lateral carina between eye and scrobe; forehead broader than greatest distance between scrobes.
- 15 (16). Head and pronotum clothed with long erect scales matted together by an earth-like exudation; elytra with a solitary wart-like elevation at base of stria 1; scape clavate, its stem not much thicker than funicle. .... *Embrithodes*, gen. nov.
- 16 (15). Head and pronotum with normal flat scales elytra without a solitary

- wart-like elevation at base; scape cylindrical, very stout, much thicker than funicle.
- 17 (18). Forehead as broad as base of rostrum; joint 2 of funicle longer than 1; front margin of prosternum truncate . . . . *Opseotrophus* Fst.
- 18 (17). Forehead narrower than base of rostrum; two basal joints of funicle equal; front margin of prosternum sinuate . . . . . *Peribrotus* Gerst.
- 19 (14). Rostrum with a sharp lateral carina running longitudinally between scrobe and eye; forehead much narrower than greatest distance between scrobes . . . . . *Opseodes*, gen. nov.
- 20 (13). Metepisternal suture complete to hind coxae; rostrum with a lateral carina between scrobe and eye; forehead broader than space between scrobes. *Sphrigodes* Gerst.
- 21 (2). Epistome short, its posterior margin rounded or transverse and not extending behind front margin of scrobes.
- 22 (23). Scrobes lateral, hardly visible from above; club of antennae not wider than funicle; corbels of hind tibiae partly squamose inside; mentum sessile . . . . . *Peritelomus* Fst.
- 23 (22). Scrobes subdorsal, broadly visible from above; club of antennae wider than funicle; corbels of hind tibiae bare inside; mentum resting on a peduncle of the submentum.
- 24 (25). Epistome reduced to a very narrow transverse strip at extreme apex of rostrum without any carina, the space between it and scrobes densely squamose; joint 1 of funicle longer than 2 . . . . . *Sphrigodellus*, gen. nov.
- 25 (24). Epistome with its posterior margin forming an arcuate carina, the space between it and scrobes devoid of scales; joint 1 of funicle not longer than 2.
- 26 (27). Rostrum separated from head by a fine stria that is clearly visible through the scaling; no bare calli at base of elytra . . . . . *Cadoderus* Muhl.
- 27 (26). Stria between head and rostrum obsolete or entirely concealed by scaling; elytra with small bare calli at base of suture.
- 28 (29). Metepisternal suture complete; interscrobial area of rostrum roundly dilated; forehead and dorsal area of rostrum clothed with very dense matted curled, erect setae . . . . . *Plocometopus*, gen. nov.
- 29 (28). Metepisternal suture obsolete behind; interscrobial area of rostrum parallel-

- sided; forehead and dorsal area of rostrum squamose.
- 30 (31). Rostrum not or but slightly longer than broad; prothorax of equal width at base and apex; hind coxae reaching elytra; scales on upper side flat . . . . . *Onchophyes*, gen. nov.
- 31 (30). Rostrum twice as long as broad; prothorax much narrower at apex than at base; hind coxae narrowly separated from elytra; scales on upper side concave . . . . . *Stenorhamphus*, [gen. nov.]
- 32 (1). Mentum bearing four or more setae.
- 33 (34). Rostrum entirely continuous with head, parallel-sided, interscrobular area not wider than a scrobe; mesosternum with a median tubercle . . . *Holoprosopus*, gen. nov.
- 34 (33). Rostrum separated from head by a stria or sulcus.
- 35 (44). Epistome quite undefined or very short and not extending behind the front margin of scrobes; joint 1 of antennal club shorter than the rest together.
- 36 (43). Rostrum separated from head by a more or less shallow angulated stria, scrobes open at the apex.
- 37 (38). Metepisternal suture obsolete behind, elytra with intervals 3 and 5 more or less elevated, at least near base.
- 38 (37). Metepisternal suture complete; elytra with intervals 3 and 5 not elevated . . . *Ischnobrotus* Hust.
- 39 (40). Lobes of mesosternum externally adjoining coxae opaque and densely squamose; scape of antennae with broad scales . . . . . *Anaplesius* Muhl.
- 40 (39). Lobes of mesosternum bare, shiny, impunctate; scape setose only or with sparse hair-like scales.
- 41 (42). Genae much dilated, interscrobular area strongly rounded laterally and broader than forehead; mentum with four setae . . . . . *Mecostylus* Klb.
- 42 (41). Genae only slightly dilated, interscrobular area with the sides straight and slightly diverging, narrower than forehead; mentum multisetose . . . *Merullosa*, gen. nov.
- 43 (36). Rostrum separated from head by a broad, deep transverse sulcus, scrobes closed at apex; metepisternal suture abbreviated . . . *Cisnodicasticus* Hust.
- 44 (35). Epistome sharply defined and extending far behind front margin of scrobes; joint 1 of antennal club as long as the rest together.
- 45 (46). Elytra subquadrate or suboblong, broadly rounded behind . . . . . *Epipedosoma* Chev.
- 46 (45). Elytra ovate, acuminate behind . . . *Mecomerinitus* Fst.

Faust (Stett. ent. Zeit. 1898, p. 219) distinguishes *Mecomeranthus* also by characters derived from the mesepisternal suture and the second ventrite, but neither of these is reliable if all the species of *Epipedosoma* are taken into account.

SIMODES, gen. nov.

*Head* separated from rostrum by a distinct angulated stria; forehead only a little narrower than base of rostrum; eyes moderately convex, their hind margin raised above the level of the temple and projecting backwards as a sharp angle when viewed from above (when the head is fully withdrawn into the prothorax the eyes fit closely against the pronotal margin and the angulation cannot be seen) *Rostrum* very stout, very slightly broader than long, parallel sided, the genæ quite undilated, the dorsal area with its margins quite straight and parallel; scrobes lateral, narrow and parallel-sided; epistome not sharply defined, its hind margin forming an acute angle behind the front margin of the scrobes; mentum small, almost round, sessile, with two setæ. *Antennæ* stout, densely squamose: scape short, somewhat curved, scarcely exceeding front margin of prothorax, gradually widening distally: funicle with joint 1 longer than 2; club broadly ovate. *Elytra* broadly ovate, with a subhumeral prominence and ten regular striae. *Legs* short and stout; hind tibiæ denticulate, the corbels broadly enclosed and partly squamose internally; hind coxæ reaching elytra. *Sternum* with front margin of prosternum deeply sinuate: mesosternum with a sharp median tubercle; metepisternal suture abbreviated. *Venter* with ventrite 2 only slightly longer than 3 and shorter than 1 behind a coxa; intercoxal process very little wider than a coxa.

Genotype: *Simodes vittatus*, sp. n.

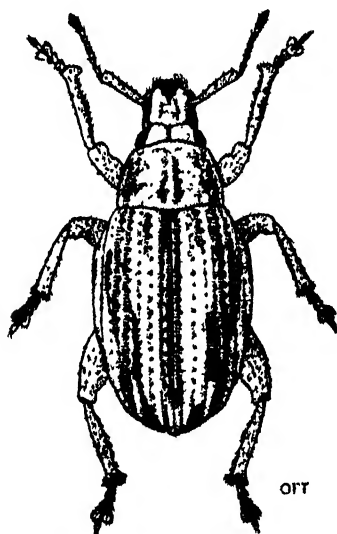
Two other species are known, but the material is inadequate for description.

The posterior angulation of the eyes is unique in the tribe, but may be easily overlooked when these organs are pressed close up against the pronotum, though this is in itself a correlated distinction, for in the other genera the eyes do not normally touch the pronotum.

*Simodes vittatus*, sp. n. (Fig. 1.)

♂♀. Derm black, with dense whitish scaling and pale brown stripes; rostrum with a median brown patch; pronotum with three sharply-defined broad brown stripes, the middle one divided by a narrow stripe of whitish scales; elytra with a brown sutural stripe (including stria 1) extending from the base to the top of the declivity; a discal brown stripe running from base to middle between striae 4 and 6, then turning inwards and running for a

Fig. 1.

*Simodes vittatus*, sp. n., ♀.

short distance between striae 3 and 5, and on the declivity confined to interval 5 (sometimes confined to this interval from the middle to the apex); and a paler, indefinite, very variable sublateral stripe running somewhat obliquely from below the humeral prominence to the middle of the posterior declivity; underside pale fawn.

*Head* with a shallow transverse depression just behind the eyes; forehead flat, with a short deep median sulcus. *Rostrum* subquadrate, the parallel-sided dorsal area with

a short median carina on the basal half and a short sulcus on each side of it, but these almost entirely concealed by scaling. *Antennæ* black, with dense pale scaling; scape very stout, with stiff subrecumbent setæ; funicle with joints 3-6 transverse, becoming slightly shorter progressively, 7 without broad scales and mostly black like the club. *Prothorax* transverse (5 : 8), moderately rounded laterally, widest behind the middle, distinctly narrower at apex than at base, the basal margin arcuate; dorsum gently convex longitudinally, declivous anteriorly from near the base, shallowly rugulose, with a shallow interrupted sulcus on each side in a line with interval 4 of the elytra. *Elytra* broadly ovate, similar in the two sexes except that the subhumeral swelling is a little larger in ♀, widest at one-fifth from the base, which is broadly sinuate and not constricted laterally, broadly rounded posteriorly, with the actual apex (which is not visible from above) jointly acuminate; the dorsal outline continuous with that of pronotum, forming a flat curve on the basal half, highest behind the middle, the posterior declivity very steep, perpendicular in ♂, sinuate in ♀; the broad deep striæ containing large round punctures, separated by their own diameter and fully visible although entirely clothed with scaling; the convex subcostate intervals broader than the striæ, each with a row of very short sparse appressed inconspicuous setæ. *Legs* black, with dense very pale scaling.

*Length* 5-7 mm., *breadth* 3-4 mm.

KENYA : Emali Range, Sultan Hamud, 4900-5900 ft., 8 ♂♂, 12 ♀♀, iii. 1940.

#### LEUROSCAPUS, gen. nov.

*Head* separated from the rostrum by a deep angulated sulcus, appearing like a fine stria when the dense scaling is intact; eyes entirely lateral, strongly convex, highest far behind the middle. *Rostrum* very stout, as broad as long, with the sides nearly parallel, the genæ being undilated, the dorsal area as wide at the base as at the apex, its sides shallowly sinuate; scrobes sublateral, only narrowly visible from above (the sides of the genæ being visible beyond them), parallel-sided, and extending deeply and without scaling to within a short distance from the



eyes; epistome not very sharply defined, running backwards in an acute angle far behind the front margin of the scrobes; mentum sessile, with two setæ. *Antennæ* stout, densely squamose; scape very broad, strongly compressed, widening close to the base and almost parallel-sided from there to the apex; funicle with the two basal joints equal, club broadly ovate. *Prothorax* strongly transverse, the base arcuate, the basal angles rounded. *Elytra* subglobose, with ten rows of punctures which are almost concealed by the dense scaling, the base broadly sinuate with the external angles projecting sharply forwards, and a bare callus at the base of the suture. *Legs* with the hind tibiæ denticulate, without a muero; hind coxæ reaching the elytra. *Sternum* with a sharp median mesosternal tubercle; metasternum much shorter than a median coxa, the metepisternal suture obsolete in the posterior half. *Venter* with ventrite 2 shorter than 3 and 4; intercoxal process broader than a hind coxa (4:3).

Genotype: *Leuroscopus tessellatus*, sp. n.

A somewhat isolated genus distinguished by its short parallel-sided rostrum, flattened scape, and by the base of the elytra embracing the pronotum.

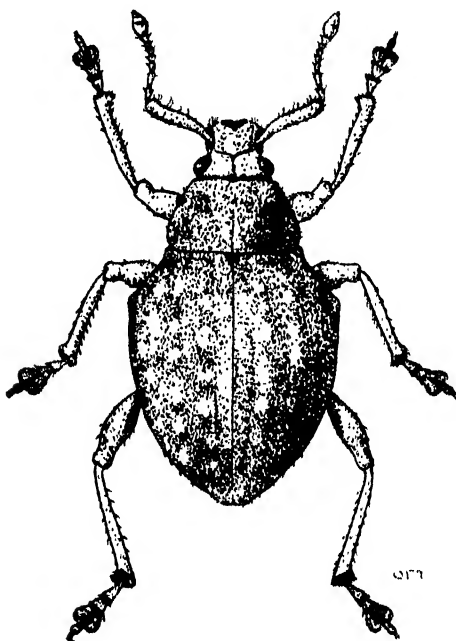
*Leuroscopus tessellatus*, sp. n. (Fig. 2.)

♂. Derm black, with dense sandy or brownish-grey scaling; elytra with faint rows of distant paler spots on intervals 2, 4, 6, 8.

*Head* densely squamose, the scales on the convex vertex round and flat, those on the somewhat flattened forehead erect and densely packed, the frontal sulcus deep. *Rostrum* with the broad dorsal area appearing almost flat on the basal half with the lateral margins rounded off, but this is due to the dense erect scales which conceal the strong median and rather lower lateral carinæ, the anterior part of the area with round flat contiguous scales. *Antennæ* black, with dense concolorous scaling throughout; the broad scape with sparse short stiff suberect setæ; funicle with joints 4-7 about as long as broad, 3 a little longer. *Prothorax* twice as broad as long, broadest close to the base (the angles of which are rounded off) and narrowing rapidly with a

slight curve to the apex, without any apical constriction ; dorsum flat longitudinally in the middle, but sloping from base to apex, the shagreened derm entirely hidden by flat contiguous fluted scales (rather larger than those on the elytra) and a few short appressed setae. *Elytra* very broadly ovate, widest at one-fourth from the base, the sides almost straight from the basal angle to a large

Fig. 2.

*Leuroscopus tessellatus*, sp.n., ♀.

subhumeral prominence (more marked in ♀) and rapidly narrowing with a curve from there to the jointly acuminate apex, the basal angles projecting acutely forwards ; dorsum strongly convex longitudinally, forming an almost continuous outline with the pronotum and steeply declivous behind, becoming vertical towards the apex ; the rows of shallow separated punctures almost entirely concealed by the dense scaling ; the intervals broader than the punctures, finely shagreened beneath the scaling,

intervals 2, 4, 6, 8 slightly broader than the others and with a few sparse erratic punctures as large as those in the rows; the short spatulate subrecumbent setæ forming a denser row on the narrower intervals. *Legs* rather stout, with dense grey scaling.

*Length* 4.5–6.0 mm., *breadth* 2.5–4.0 mm.

NYASALAND: Cholo, 2 ♂♂, 5 ♀♀ (*R. C. Wood*).

#### EPICASTICUS, gen. nov.

*Head* separated from the rostrum by an angulated sulcus; eyes lateral, convex. *Rostrum* with the scrobes sublateral, widely separated, only narrowly visible from above, and the sides of the genæ visible beyond them; dorsal area shallowly sinuate laterally; epistome well defined, produced backwards into a sharp angle; mentum with two setæ. *Antennæ* densely squamose throughout; scape nearly reaching the middle of the prothorax, very gradually widening to apex; funicle with the two basal joints equal; club small, fusiform. *Elytra* ovate, with ten regular rows of punctures, the punctures separated by short transverse ridges. *Sternum* with a sharp meso-sternal tubercle; metepisternal suture abbreviated. *Venter* with the intercoxal process wider than a coxa, ventrite 2 as long as 3+4.

Genotype: *Epicasticus vansomereni*, sp. n.

The general facies is like that of *Peritmetus* Klb. (which, however, has twelve striæ on the elytra) and the sculpture of the elytra is very similar to that of *Amphitmetus transversus* Klb.

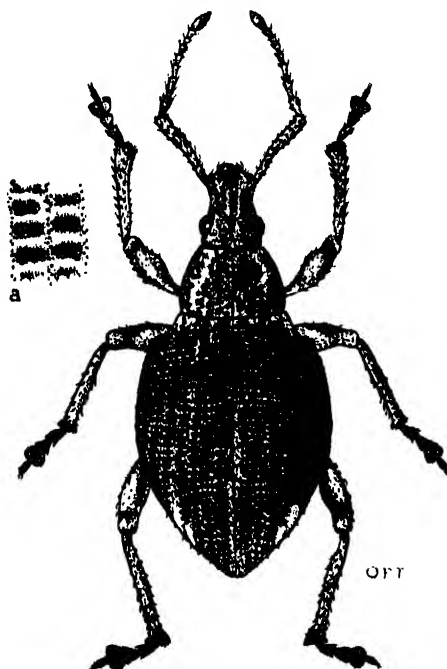
#### *Epicasticus vansomereni*, sp. n. (Fig. 3.)

♂♀. Derm black; head and rostrum with dense pale fawn scaling and some metallic green scales at the apex of the rostrum and behind the eyes, much or most of the lower surface also green; prothorax with green scales between the granules, an irregular broad fawn stripe on each side and another adjoining the coxæ; elytra with pale green scales in the punctures or depressions, the almost obliterated intervals indicated by a narrow stripe of mostly coppery scales, an elongate pale patch on each side of the declivity, a pale stripe on the apical fourth of the lateral margin, and the suture with a stripe of mixed

fawn and green scales; underside coppery fawn, with a broad median green stripe on the venter.

*Head* densely squamose, the median sulcus very broad and deep in front, narrowing behind. *Rostrum* longer than broad (6:5), parallel-sided in the basal half and only moderately dilated at the genæ; the dorsal area almost flat in the basal half, longitudinally rugulose

Fig. 3.



*Epicaesthus vansomereni*, sp. n., ♀; a, punctures on elytra, enlarged.

beneath the dense scaling, with a low scale-covered median carina, the anterior half broadly and deeply impressed, containing the elevated epistome. *Antennæ* black, with dense fawn scaling; scape strongly curved in the basal half, with numerous short stiff subrecumbent setæ; funicle with joint 1 as long as 2 and only slightly thicker, the distal joints narrowing and all much longer

than broad. *Prothorax* transverse (3:4), widest at the base, gradually narrowing in front, with the sides slightly rounded, truncate or feebly arcuate at the base, shallowly sinuate at the apex; dorsum moderately convex longitudinally, highest behind the middle, with numerous separated bare flat shiny granules, which are much sparser in the pale stripes, and a very fine low median carina. *Elytra* ovate, acuminate behind, widest at the basal fourth, wider and more acuminate in ♀, truncate or feebly sinuate at the base; dorsum moderately convex, forming almost a continuous curve with the pronotum, highest at about the middle steeply declivous at the apex in ♀, much less so in ♂; the shallow transverse punctures separated in the rows by short low transverse bare ridges, which rarely coalesce laterally and are higher than the very narrow inconspicuous interrupted intervals between the rows of punctures; the scales small, round and contiguous, except the pale ones near the apex which are much larger and overlapping, the intervals with a row of short inconspicuous subrecumbent pale setae. *Legs* red brown with the tarsi black, fairly densely clothed with pale scales and with short subrecumbent pale setae; hind tibiae of ♂ with very small denticles.

*Length* 7-10 mm., *breadth* 3.2-5.5 mm.

**KENYA:** Rabai, 1 ♂, i. 1924 (*Dr. V. G. L. van Someren*), 1 ♂, 2 ♀♀, i.-ii. 1929 (*A. F. J. Gedye*), 4 ♂♂, 4 ♀♀, viii. 1937 (*V. G. L. v. S.*); Shimba Hills, 6 ♂♂, 10 ♀♀, iii. 1941 (*V. G. L. v. S.*—type), 7 ♂♂, 2 ♀♀, vii. 1939. **ZANZIBAR:** 1 ♂.

#### EMBRITHODES, gen. nov.

*Head* clothed with dense erect clavate scales, matted together by an earthy secretion, the stria separating it from the rostrum normally concealed; forehead very nearly as broad as base of rostrum; eyes lateral, moderately convex. *Rostrum* about as long as broad, with genae dilated; scrobes subdorsal, broadly visible from above, the greatest space between them narrower than the forehead; dorsal area broad, distinctly sinuate laterally; epistome acuminate posteriorly and extending far behind front margin of scrobes; mentum sessile, with two setae. *Antennae* densely squamose; scape

slightly curved, gradually clavate; funicle with the two basal joints equal; club broadly ovate. *Prothorax* clothed dorsally with erect scales like those on head. *Elytra* ovate, with ten regular striae, and a flat triangular callus at the base of stria 1; striae 5 and 6 separate at the base. *Legs* with hind tibiae denticulate and with a mucro, corbels broadly enclosed. *Sternum* without a mesosternal tubercle; metepisternal suture obsolete behind. *Venter* with intercoxal process not wider than a coxa; ventrite 1 behind a coxa much longer than 2.

Genotype: *Embrithes muscosus* Gerst.

*Embrithes* Schönh., which is known so far only from the Cape Province of South Africa, differs from this genus as follows:—The head, rostrum, and prothorax are clothed with normal flat scales; eyes subdorsal, forehead much narrower than base of rostrum; funicle with joint 1 longer than 2; elytra without any basal calli, striae 5 and 6 uniting at base; ventrite 1 not longer than 2 behind a coxa.

The only other species known to me that will come within the genus are *Embrithes concinnus* Fst. and *E. suturalis* Har.

The four species of *Embrithes* described by Faust from S. Abyssinia (Ann. Mus. Civ. Gen. 1895, p. 235) certainly do not belong here, and it is very doubtful whether they are rightly placed in Schönherr's genus, but they are all unknown to me.

#### PERIBROTUS Gerst.

An examination of the types of *P. pustulosus* Gerst., 1871, and *P. proluxus* Fst., 1896, shows that the latter is undoubtedly a synonym of *pustulosus*. Faust was misled by Gerstaecker's statement that in his species the corbels of the hind tibiae are not enclosed, which is incorrect. *P. albovarius* Champ., 1911, is also a synonym of the same species.

#### OPSEODES, gen. nov.

*Head* separated from rostrum by an angulated stria; forehead narrower than the widest space between the scrobes (4:5); eyes only slightly convex. *Rostrum* elongate, much longer than its basal width, strongly

dilated at the genæ; dorsal area sloping laterally, with two sharp carinæ on each side, deeply incised in front by the incurved scrobes, which are broadly visible from above; epistome rather short, bounded behind by an angulated carina which extends behind the front margin of the scrobes, the space between it and the scrobes bare and impressed; mentum sessile, with two setæ. *Antennæ* elongate, densely squamose; scape slender, curved, gradually clavate; funicle with joint 2 much longer than 1; club elongate, fusiform. *Elytra* broadly ovate in ♂, globose in ♀, with ten regular striæ. *Legs* with hind tibiæ denticulate, the corbels broadly enclosed, bare inside; hind coxæ reaching elytra. *Sternum* with front margin of prosternum truncate, mesosternum without a tubercle, metepisternal suture obliterated behind. *Venter* with the intercoxal process a little wider than a coxa, ventrite 2 very slightly longer than 3.

Genotype: *Opseodes piger*, sp. n.

The ♂ superficially resembles *Sphrigodes*, but apart from its complete metepisternal suture, the latter differs in its much shorter rostrum and subconical prothorax. The globose ♀ is much like an *Opseotrophus*, but the latter may be distinguished by its very thick scape, broad forehead and convex eyes, and the rostrum lacks the second lateral carina.

Only a single species is known.

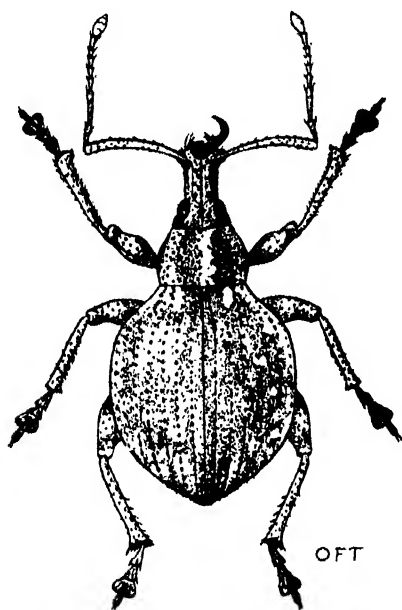
*Opseodes piger*, sp. n. (Fig. 4.)

♂♀. Derm black, with dense brown scales and paler markings of grey to yellowish scaling; head and rostrum entirely pale; prothorax with a variable irregular median pale stripe and a much broader one on each side, the latter stripes with a quadrate emargination in the middle of the upper edge; elytra with a very ill-defined broad sublateral macular pale stripe from base to declivity but not extending to the lateral margin, and scattered small pale spots on the disk; underside with dense pale scaling and large brown patches on the sides of the sternum.

*Head* with dense scaling and a deep median stria. *Rostrum* longer than its width (5:4), parallel-sided from base to middle, broadly dilated at the genæ; dorsal area with the inner carinæ parallel from base to scrobes, the space between them flat with a very fine low median

carina. *Antennæ* black, with distal joints of funicle much longer than broad, 3 to 6 progressively diminishing, 7 as long as 4. *Prothorax* (2:3) rounded laterally, widest at the middle, the apex much narrower than the truncate base; dorsum gently convex longitudinally, highest behind the middle, with sparse, large shallow bare punctures, each containing a short clavate dark recumbent seta. *Elytra* strongly rounded laterally, widest before the middle, sinuate at the base, which is shallowly

Fig. 4.

*Opiodes piger*, sp. n., ♀.

constricted laterally, obtusely acuminate at the apex; dorsal outline moderately convex in ♂, continuous with that of the prothorax, highest behind the middle, and very steeply declivous behind; dorsal curvature much stronger in ♀, not continuous with that of the pronotum but sloping steeply to the base, highest at the middle, and vertical at the apex; the narrow shallow striae with



widely spaced bare round punctures, which in striae 1-3 near the base have a small shiny granule on their anterior margin; intervals broad and flat, with finely striolate convex scales and a row of very inconspicuous small recumbent clavate setae, interval 1 being quite bare at the base for a distance of two or three punctures. *Legs* black, with dense pale scaling, the posterior pairs of femora with dark scales in the middle and at the apex.

*Length*, ♂ 5.0-6.2, ♀ 6.0-9.0 mm.; breadth, ♂ 3.3-3.5, ♀ 3.5-5.0 mm.

KENYA: Lower Tana R. to Sabaki, 4 ♂♂, 5 ♀♀, iv.-v. 1932 (H. J. Allen Turner & McArthur-type); Sekoke, 1 ♂, 1 ♀, vii. 1932 (H. J. A. Turner).

#### SPHRIGODES Gerst.

On critical examination this genus proves to be composite. In the typical East African species (genotype, *margaritaceus* Gerst.) the elytra have 10 striae and the mesepisternal suture is complete; other East African species (*variegatus* Hartm. and *globulus* Mshl.) have this suture much abbreviated and 16 striae; whereas all the South African species have the suture also abbreviated, but only 10 striae on the elytra.

Thus restricted, the genus *Sphrigodes* occurs only in East Africa and contains the following species:—*margaritaceus* Gerst., *miser* Fst. (*Embrithes*), *plagiatus* Fst. (*Embr.*), *vicinus* Hartm., *babaulti* Hust., *griseus* Hust., *subdenudatus* Hust., and probably *mixtus* Hust. (unknown to me).

#### AMPHITRETUS, gen. nov.

This multistriate genus differs from *Sphrigodes*, as stated above, in having 16 striae on the elytra and in the abbreviation of the metepisternal suture; the form of the rostrum also differs, in that the scrobes curve inwards less strongly behind and the excision of the dorsal area is much less deep.

Genotype: *Sphrigodes variegatus* Hartm.

*Sphrigodes globulus* Mshl. must also be transferred to this genus, and two other East African species are known, but from single specimens only.

## MESPHRIGODES, gen. nov.

This genus includes the four South African species that have hitherto been included in *Sphrigodes*:—*ornatus* Fhs. (genotype), *decorus* Mshl., *depressifrons* Mshl., and *lateralis* Mshl. (1938).

The genus differs from *Sphrigodes* in having the metepisternal stria abbreviated; the rostrum is differently shaped, being much more steeply declivous laterally, with the sides of the dorsal area much less deeply sinuate; and the two basal joints of the funicle are equal, whereas in *Sphrigodes* and *Amphitretus* joint 2 is longer than 1.

## SPHRIGODELLUS, gen. nov.

Head separated from rostrum by an angulated stria; eyes lateral, convex. Rostrum longer than broad, slightly and gradually widening from base to apex, without carinae or sulci; scrobes subdorsal, short, curving inwards behind; dorsal area sinuate laterally, twice as wide as a scrobe between the scrobes, the apical margin truncate, with an extremely short transverse epistome without any carina, the dense scaling being continued right up to its margin; mentum pedunculate, with two setae. Antennae with only the scape densely squamose and extending beyond the margin of the prothorax, only slightly curved at the base, thence straight and gradually clavate at the apex; funicle with joint 1 longer than 2, the distal joints moniliform and bare; club ovate, rather short. Prothorax as long as broad, the gular margin sinuate. Elytra broadly ovate, with ten regular striae. Sternum without any tubercle on the mesosternum; metepisternal suture abbreviated; hind coxae reaching elytra. Venter with the intercoxal process twice as wide as a coxa, ventrite 2 nearly as long as 3+4. Scaling: all the dorsal scales concave, or with a median puncture.

Genotype: *Barianus centralis* Hust., 1929.

The extremely short transverse epistome and the extension of the scaling right up to the apical margin of the rostrum will distinguish this genus from all those here associated with it. *Cadoderus lepidus* Mshl., 1940, must also be included in the genus.

*Barianus* is a purely Madagascar genus, with a very different head and rostrum; these together form a regular

cone, with the eyes flat and dorsal, so that the sides of the head can be seen from above, and the interscrobial area is not wider than a scrobe; the intercoxal process of the venter is not broadly truncate, but ogival and not wider than a coxa, and ventrite 2 is much longer than 3 + 4.

*PLOCOMETOPUS*, gen. nov.

*Head* separated from rostrum by a broad shallow sulcus, which is entirely concealed by long erect matted curled setæ that extend from the forehead along the dorsal area of the rostrum to the antennæ; forehead much narrower than base of rostrum; eyes almost flat, subdorsal. *Rostrum* stout, a little longer than broad, widening somewhat at the genæ; dorsal area narrowing rapidly from base to antennæ, where it is narrower than the middle of the scape, the widest space between the scrobes half as wide as the forehead; scrobes dorsal, very broad, ending before middle of rostrum; epistome very short, nearly vertical, the posterior margin with a sharp arcuate carina; mentum sessile, with two setæ. *Antennæ* densely squamose; scape stout, cylindrical, reaching middle of prothorax, with stiff curved setæ; funicle with joint 2 longer than 1; club narrowly ovate. *Prothorax* slightly wider at the truncate base than at apex, clothed with densely matted feathery scales, presenting a fine sponge-like texture. *Elytra* broadly ovate, with ten fine striae, stria 1 with two or three shiny granules at its base. *Legs* with the hind tibiae finely denticulate and mucronate, the corbels narrowly enclosed. *Sternum* with the mesepisternal suture complete. *Venter* with the intercoxal process about as broad as a coxa, the three intermediate ventrites subequal.

Genotype: *Meira scutellata* Hust. 1929 (later transferred to *Cadoderus*).

The only known species is a rather aberrant one, which cannot be retained in *Cadoderus* on account of its complete metepisternal suture.

*ONCOPHYES*, gen. nov.

*Head* separated from rostrum by a shallow sulcus, which is, however, entirely concealed by scaling; eyes flat, width of forehead equal to or less than length of

an eye. *Rostrum* stout, as long as broad, gradually widening from base to apex, with the sides straight; dorsal area much narrowed between the scrobes, being there parallel-sided and not wider than a scrobe, the latter being dorsal and very broad, almost or quite as broad as long; epistome very short, vertical, its posterior margin with an arcuate carina, not nearly reaching the scrobes, the space between them bare; mentum very shortly pedunculate, with two setae. *Antennae* with scape slightly widening from base to apex, with dense scaling and stiff curved setae; funicle with the two basal joints equal. *Prothorax* very nearly as long as broad, of equal width at base and apex. *Elytra* ovate, acuminate behind, with ten striae and two small calli at the base of the suture. *Legs* with the hind tibiae denticulate and mucronate, the corbels rather narrow and bare; hind coxae reaching elytra. *Sternum* without a mesosternal tubercle; metepisternal suture abbreviated. *Venter* with the intercoxal process as broad as a coxa; ventrite 2 shorter than 1 behind a coxa.

Genotype: *Ellimenistes amoenus* Hartm. (later transferred to *Cadoderus*).

In addition to the distinctions given in the Key, *Cadoderus* differs from this genus in its more convex eyes and much more slender antennae, which have a clavate scape.

A second undescribed species is known.

#### STENORRHAMPHUS, gen. nov.

*Head* separated from rostrum by a sulcus that is entirely concealed by dense erect scaling; eyes almost flat. *Rostrum* elongate, twice as long as broad, with the genae scarcely dilated; dorsal area almost parallel-sided, the space between scrobes only a little more than half as wide as forehead; scrobes subdorsal, broadly visible from above; epistome very short, steeply declivous, its hind margin arcuately carinate, remote from the scrobes, the space between them being bare of scaling; mentum resting on a peduncle of the submentum, bearing two setae. *Antennae* long, slender, partly squamose; scape gradually clavate, almost straight; funicle with the two basal joints equal. *Elytra* broadly ovate, with ten regular striae and dense concave scales. *Legs* with the hind tibiae not denticulate but with a sharp mucro, the corbels

rather narrowly enclosed, front tibiae with the external apical angle somewhat produced outwards; hind coxae narrowly separated from elytra. *Sternum* with the front margin of prosternum sinuate; mesosternum without a median tubercle, metepisternal suture obsolete behind. *Venter* with the intercoxal process as wide as a coxa; ventrite 1 behind the coxae much longer than 2.

Genotype: *Sphrigodes crinitus* Mshl., 1934.

Only a single species is known at present; it is a small insect (about 3 mm.), readily recognisable by its very long, sharply pointed, erect setae and concave scales. From *Sphrigodes* it differs also in its long, almost parallel-sided rostrum, very short epistome, and abbreviated metepisternal suture.

#### HOLOPROSOPUS, gen. nov.

*Head* continuous with the rostrum without any dividing stria; eyes lateral, moderately convex. *Rostrum* as long as broad, parallel-sided, the genae not dilated, the dorsal area with its sides straight and rapidly narrowing from base to apex, the space between the scrobes not wider than a scrobe; scrobes dorsal, very broad; epistome short, its posterior margin with a strongly arcuate carina that does not exceed the front margin of scrobes; mentum on a very short peduncle, with four setae. *Antennae* with the scape densely squamose; funicle with the two basal joints equal. *Prothorax* transverse, narrower at apex than at base. *Elytra* ovate, somewhat constricted at base, with ten striae. *Legs* with the hind tibiae denticulate and sharply mucronate, the corbels narrowly enclosed; hind coxae reaching elytra. *Sternum* with a sharp tubercle on mesosternum; metepisternal stria abbreviated. *Venter* with the intercoxal process as broad as a coxa, ventrite 2 a little shorter than 1 behind the coxae.

Genotype: *Holoprosopus segnis*, sp. n.

#### *Holoprosopus segnis*, sp. n.

♂♀. Derm black, with dense greyish-brown scaling; prothorax with a very faint paler median stripe; elytra with indefinite variable lighter and darker markings.

*Head* densely squamose, forehead flat, with a median stria. *Rostrum* stout, parallel-sided; dorsal area nar-

rowing from base to apex, broadly depressed in the middle. *Antennæ* with the scape rather elongate, gently curved, very gradually widening from base to apex, with stiff curved pale setæ in addition to the dense scaling; funicle with the distal joints longer than broad and clavate. *Prothorax* (3:4) moderately rounded laterally, widest behind the middle, narrower at apex than at the truncate base; dorsum with a broad shallow transverse impression across the apical half and a very shallow round depression on each side near the base, densely squamose, with short dark subrecumbent scale-like setæ and a few narrower erect setæ near the apical margin. *Elytra* ovate, a little broader and more acuminate behind in ♀, somewhat constricted at the base, with the basal angles projecting slightly forwards; dorsal outline moderately convex, the posterior declivity steep, becoming vertical in ♀; striæ narrow, with fine punctures showing through the scaling; intervals almost flat, with partly overlapping scales and a sparse row of spatulate setæ which are subrecumbent on the disk and erect on the declivity. *Legs* black, except the tarsi which are red-brown, with dense greyish-brown scaling, the posterior pairs of femora with the basal half mostly dark brown.

*Length* 3.7–5.0 mm., *breadth* 2–3 mm.

KENYA: Kiambu, 6 ♂♂, 2 ♀♀, 1931 (R. H. Le Pelley—type); Fort Hall, 1 ♀, iv. 1938 (C. D. Knight).

#### MERULLODES, gen. nov.

*Head* separated from rostrum by a very shallow, sometimes partly obsolete, angulate stria; eyes widely separated, strongly convex. *Rostrum* stout, somewhat longer than broad, the dorsal area very broad, widest beyond the antennæ, its sides straight or shallowly sinuate; epistome ill-defined; genæ moderately dilated, the scrobes broadly visible from above; mentum with 4–6 setæ. *Antennæ* elongate; scape slender, gradually clavate, devoid of scaling, with very short fine pale suberect setæ; funicle with joint 1 longer than 2, the distal ones elongate and clavate; club narrowly fusiform. *Elytra* elongate, ovate, a little wider at the base than the base of the prothorax, with ten regular striæ and with an obtuse callus on each side adjoining the apex. *Legs* slender; hind femora not exceeding the apex of ventrite 4;

hind tibiae denticulate, the corbels broadly enclosed; hind coxae reaching the elytra. *Sternum* with the metepisternal suture complete; mesosternal process convex but not tuberculate. *Venter* with ventrite 2 as long as 3+4, ventrite 5 of ♀ with an apical elevation.

Genotype: *Merulla callosa* Hust., 1929.

The genus *Merulla* Aur. has the corbels of the hind tibiae narrowly enclosed and the small mesepisterna are remote from the base of the elytra, so that it belongs to the tribe Peritellini.

Another species which must be referred to *Merulloses* is *Amphitmetus gibbosus* Hust., and a third is described below. All three species have a callus close to the apex of the elytra, and this character may prove to have a generic value. The genus appears to be alpine in distribution.

*Merulloses djemensis*, sp. n.

♀. Dull black, entirely devoid of scaling above and below.

*Head* with the forehead flattened in the middle and with coarse confluent punctation. *Rostrum* with the broad dorsal area shallowly impressed, longitudinally striolate, its margins subcostate, straight and diverging somewhat in front; the apical area shallowly impressed, its posterior margin forming a broad curve between the antennae. *Antennae* slender, black; scape quite straight. *Prothorax* (4:5), moderately rounded, broadest behind the middle, the apex much narrower than the arcuate base; dorsum with very shallow confluent punctation, a large trapezoidal area on the disk which is flat near the apex and broadly and deeply impressed behind, and two much shallower rounded impressions on each side. *Elytra* ovate, widest at one-fourth from the base, which is broadly sinuate and somewhat constricted laterally, the sides shallowly sinuate near the apex, which appears obtusely truncate viewed from above owing to two large smooth subapical calli, the actual apex being acuminate and shortly produced downwards; the rather large round separated punctures forming quite regular rows, the intervals not wider than the punctures, set with numerous irregular granules, most of which are flattened and transversely elongate, those on the lateral intervals minute.

*Legs* red-brown, with the tarsi fuscous, slender, finely setose, entirely devoid of scales, the teeth on the hind tibiae very small. *Venter* of ♀ almost glabrous in the middle, shagreened laterally, ventrite 5 punctate and with an elongate smooth tubercle.

*Length* 12 mm., breadth 6 mm.

ABYSSINIA: Djemdjem Forest, 8000-9000 ft., 1 ♀, ix.-x. 1926 (Dr. H. Scott).

The ♀ of *M. callosa* Hust. differs in its green scaling; the prothorax is only somewhat flattened on the disk with a single fovea on each side; and the elytra bear very shallow, more or less irregular punctures, the base being truncate and not compressed laterally. *M. gibbosus* Hust. differs *inter alia* in its very much more finely sculptured surface, the punctures on the elytra being barely half the width of the intervals and bordered anteriorly by distinct granules.

*Mecostylus granulatus*, sp. n.

♂♀. Derm black, moderately shiny, appearing bare but actually with very minute sparse greenish-white scales; in one ♀ only there is a short sublateral stripe of broad white scales on the basal half of the pronotum and on the elytra a diffuse humeral spot of similar scales and a still more diffuse spot at a short distance behind it; posterior pairs of femora with a dorsal patch of white scales; underside almost devoid of scales.

*Head* with shallow, more or less confluent punctures and a deep frontal fovea. *Rostrum* elongate, parallel-sided and subcylindrical in the basal half, broadly and abruptly dilated at the genæ; dorsal area with its lateral margins rounded off and not carinate on the basal half, flat on the disk, with a flattened median carina and a few punctures on each side of it; epistome undefined, the whole apical and interscrobal area being smooth, impunctate and almost flat; lateral area with an almost impunctate stripe between eye and scrobe, without any definite sulcus. *Antennæ* black, without any scaling; *scape* elongate, slender, gently curved, abrupt clavate; *funicle* with the two basal joints subequal, the distal joints all longer than broad and subconical, 3-6 gradually diminishing, 7 as long as 6. *Prothorax* nearly as long as broad in ♂, slightly more transverse in ♀, rather strongly



rounded laterally, widest well in front of middle, narrower at apex than at base; dorsum gently convex longitudinally, highest at a little behind the middle, with separated low shiny granules, which are smaller and more distant on the pleuræ. *Elytra* narrowly elliptical in ♂, much broader in ♀, subtruncate at the base, which is not constricted, obtuse at the apex, there being a large granulate callus on each side of it in ♂, much reduced in ♀, in which the apex is produced downwards like a beak; the shallow striæ containing rounded punctures which are separated by low shiny granules, the intervals about as wide as the striæ and each with a row of similar granules, which are smaller and more remote on the lateral intervals, especially in ♀; interval 7 in ♀ has a strong granular costa on the basal third. *Legs* red-brown, with the knees and tarsi black, clothed with whitish setæ in addition to the dorsal patches of dense white scales on the posterior femora. *Sternum* with very small sparse granules on the sides of the metasternum, which are sometimes laterally confluent in ♀. *Venter* with the intermediate ventrites shiny and almost impunctate; ventrite 1 opaque, that of ♂ with a broad median depression and a rugose area on each side of it set with short erect yellowish setæ; ventrite 5 of ♀ with the apex bent downwards in conformity with the elytra.

*Length* 10.5–14.5 mm., *breadth* 4.0–6.2 mm.

KENYA: Wandanyi, 5000 ft., 2 ♂♂, 2 ♀♀, iii. 1939.

Readily distinguished from its congeners by the narrower rostrum, regularly granulate upper surface, the conspicuous spots on the femora, and by the sculpture of the underside.

II.—*The Formicidæ (Hym.) of the Armstrong College Expedition to the Siwa Oasis*. By HORACE DONISTHORPE, F.Z.S., F.R.E.S., &c., Department of Entomology, British Museum (Natural History).

THE following paper deals with some twenty-six forms of ants taken by Mr. Omer-Cooper in Egypt, chiefly from the Siwa oasis.

As might be expected, the majority of these insects which have already been described are known to inhabit deserts and oasis.

Of these twenty-six different forms, two species and one subspecies are new to science—these I have described. I give the recorded distribution to all the known ants in this list.

Subfamily *CERAPACHYINÆ* Forel.

Tribe *CERAPACHYINI* Forel.

1. *Lioponera cooperi* Donisthorpe, Ann. & Mag. Nat. Hist. (n. s. 11) iii. p. 255 (1939).

Two ♂♂. Egypt : Siwa, 36. vi. 35 ; Maragi, 26. viii. 35 (*J. Omer-Cooper*).

Type ♂ and paratype ♂ in B.M.

Subfamily *PONERINÆ* Lepeletier.

Tribe *PONERINI* Forel.

2. *Euponera* (*Brachyponera*) *sorghi* Roger ! Berlin Ent. Zeits. vii. p. 169 (1863), ♀.

Three ♂♂. Egypt : 2 Siwa, 30. vi. 35 ; 1 Maragi, 26. viii. 35 (*J. Omer-Cooper*).

Recorded distribution : Sudan.

Subfamily *MYRMICINÆ* Lepeletier.

Tribe *PHEIDOLINI* Emery.

3. *Messor barbarus* L., subsp. *egyptiaca* Emery, Ann. Mus. Stor. Nat. Genova, xii. p. 57 (1878).

Six ♀♀, nine ♂♂. Egypt : Siwa, vii. 35 ; Maragi, vii. 35 (*J. Omer-Cooper*).

Recorded distribution : N. Africa, Egypt, deserts.

4. *Pheidole* (*Pheidole*) *pallidula* Nyl., var. *tristis* Forel. Ann. Soc. Ent. Belg. li. p. 204 (1907).

Three ♀♀, numerous ♂♂. Egypt : Siwa, viii. 35 (*J. Omer-Cooper*).

Recorded distribution : Kairouan, Tunis (the ' Genera Insectorum ' incorrectly gives Algeria).

5. *Pheidole* (*Pheidole*) *pallidula* Nyl., var. *reticeps* Forel.

Three ♀♀, numerous ♂♂. Egypt : Siwa, Bachrein, iv., vi., viii. (*J. Omer-Cooper*).

Recorded distribution : Cairo, Sahara, Tunis.

6. *Pheidole* (*Pheidole*).

One hundred winged ♀♀. Egypt: Siwa, 10. v. 35 (*J. Omer-Cooper*). Evidently a marriage flight.

Tribe CARDIOCONDYLINI Emery.

7. *Cardiocondyla emeryi* Forel, subsp. *mahdii* Karawajew, Rev. Russe Ent. xi. p. 8 (1911).

Two ♂♂, one winged ♀, eighteen ♀♀. Egypt: ♂. Siwa. 30. vi. 35; ♀, 7. vii. 35; ♀♀, Khamissa, vi. 35; Siwa. vii. 35 (*J. Omer-Cooper*).

Recorded distribution: Khartum.

8. *Cardiocondyla nuda* Mayr, var. *mauritanica* Forel, Ann. Soc. Ent. Belg. xxxiv. p. 75 (1890).

Two dealated ♀♀, forty-two ♀♀. Egypt: Siwa, vi., vii., viii. 35 (*J. Omer-Cooper*).

Recorded distribution: North Africa, Cyprus.

Tribe CREMATOGASTERINI Forel.

9. *Crematogaster* (*Acrocælia*) *auberti* Emery, var. *oasium* Santschi, Bull. Soc. Hist. Nat. Africa Nord, iii. p. 84 (1911).

Twenty-two ♀♀. Egypt: Siwa, Khamissa, Bahrein, vi., vii., viii. 35 (*J. Omer-Cooper*).

Recorded distribution: Tunis, Kairouan.

Tribe SOLENOPSIDINI Forel.

10. *Monomorium* (*Xeromyrmex*) *bicolor* Emery, Ann. Mus. Stor. Nat. Genova, ix. p. 368 (1877).

Five ♂♂, twenty ♀♀. Egypt: Siwa, Tagyertie, vi., vii., viii. 35 (*J. Omer-Cooper*).

Recorded distribution: Abyssinia; widely distributed in Africa.

11. *Monomorium* (*Xeromyrmex*) *salomonis* L. Syst. Nat. Ed. 10, i. p. 580 (1758).

Two winged ♀♀, forty-five ♀♀. Egypt: Siwa (♀♀, 21. vii. 35; ♀♀, vi., vii., ix. 35) (*J. Omer-Cooper*).

Recorded distribution: Barbary, Syria, Central Asia, Caucasus.

12. *Monomorium* (*Xeromyrmex*) *salomonis* L., subsp. *subopaca* Smith, Cat. Hym. Brit. Mus. vi. p. 127 (1858).

Three winged ♀♀, twelve ♂♂. Egypt: Siwa (♀♀, 30. vi. 35, 18. vii. 35; ♂♂, vi., vii. 35) (*J. Omer-Cooper*).

Recorded distribution: Madeira, Canaries, Spain, Sardinia, Sicily, Greece, Morocco, Algeria, Rhodesia.

13. *Monomorium* (*Parholcomyrmex*) *gracillimum* Smith, Journ. Proc. Linn. Soc. Lond. Zool. vi. p. 34 (1861).

Forty-six ♀♀. Egypt: Gara, vii. 35 (*J. Omer-Cooper*).

Recorded distribution: Syria, Barbary, Arabia, India, Central Asia; spread by commerce.

14. *Monomorium* (*Lampromyrmex*) *atomus* Forel, subsp. *cooperi*, subsp. n.

♀. Unicolorous bright yellow, eyes black, teeth of mandibles red, very shining, some sparse erect hairs chiefly on gaster, pubescence practically nil, under a high power a few small, shallow punctures can be seen.

*Head* oblong, slightly narrower in front than behind, broadest just before posterior angles which are rounded, posterior border sinuate; *mandibles* with last two teeth sharp and prominent, the last being sharper and longer; *clypeus* convex, bicarinate; *eyes* moderate, rather flat, oblong, situated in front of middle of sides of head; *antennæ* 11-jointed, the *scapes* extend a little beyond the posterior fourth of the head. *Thorax* distinctly contracted at *meso-epinotal* suture; *petiole* very slightly higher and not so globose, but as broad as *post-petiole*.

*Long.* 1.2–1.3 mm.

♀. Posterior part of head, thorax and petiole yellowish brown, anterior part of head, antennæ, legs and post-petiole paler, gaster pale yellow, slightly darker at apex, teeth of mandibles and eyes black, whole insect very shining. Pubescence, hairs and puncturation less sparse and more distinct than in ♂.

*Head* more massive and not so long in proportion to its width as in ♂, *mandibles* more robust; *antennæ* as in ♂, but more robust, and *scape* not reaching as far back. *Thorax* narrow, rounded at sides from apex to base; *epinotum* rounded, *declivity* longer than the *dorsum*. *Petiole* and *post-petiole* much as in ♂, but more massive; *gaster* long, rather flat above, slightly convex beneath.

*Fore-wing*, discoidal cell present, one long closed cubital cell, and radial cell open, pterostigma and veins pale yellow.

*Long.* 4.4 mm.

♂. Black, mandibles, funiculi of antennæ and tarsi dirty pale yellow, scape, femora and tibiæ darker, smooth and shining, head duller, furnished with sparse, short scattered hairs, and scanty pubescence. *Head* broader than long, finely coriaceously punctured, posterior angles rounded; *mandibles* short, narrow, dentate; *clypeus* convex; *frontal area* impressed, smooth, *frontal furrow* short, but rather deep; *ocelli* moderate; *eyes* large, prominent, but not reaching base of mandibles; *antennæ* 13-jointed; *scape* shorter than the two first joints of the *funiculus*, gradually and slightly thickened towards apex. *Thorax* narrow; *mesonotum* convex, high; *scutellum* somewhat flat above; *metanotum* narrow, slightly extending above *epinotum*, which is convex and rounded; *petiole* higher than *post-petiole*, which is short and globose. *Fore-wing* as in ♀, but with *discoidal cell* wanting, more iridescent, and *pterostigma* and *veins* much paler.

*Long.* 2.5 mm.

♀ type and paratypes, and ♂ and ♀ types in Brit. Mus.

One ♂, one winged ♀, twelve ♀♀. Egypt: Siwa (♂, 30. vi. 35; winged ♀, 14. vii. 35; ♀♀, vi., vii., viii. 35) (*J. Omer-Cooper*).

#### 15. *Solenopsis*.

Over one hundred and seventy ♂♂. Egypt: Siwa. 21. viii. 35 (*J. Omer-Cooper*).

Evidently a marriage flight.

### Tribe TETRAMORIINI Emery.

#### 16. *Tetramorium minutum*, sp. n.

♀. Brownish red, gaster black, under sides of thorax, epinotum, petiole, mandibles, antennæ and legs yellow. Body furnished with scattered, semi-erect blunt hairs.

*Head* longitudinally striate; *mandibles* large, finely striate and punctate, masticatory border with two large sharp apical teeth, and four smaller ones; *clypeus* round, convex, with a narrow raised central *carina*, and two lateral ones continued along the head; *frontal carinæ* continuing nearly to posterior border of head, forming

a semi-scribe for insertion of scapes. *Thorax*, *mesonotum* and *scutellum* longitudinally striate; *epinotum* armed with two short, broad but sharply pointed projecting teeth continued in raised ridge posteriorly. space between concave, smooth; *episterna* armed with two finer sharp teeth. *Petiole* with not very short *peduncle* and sub-cuboidal *node*, somewhat flat above: *post-petiole* transverse with rounded sides, broader than *petiole*; *gaster* short, oval, smooth and shining, with scattered shallow punctures. *Fore-wing*, one *discoidal cell*, one closed *cubital cell*, *radial cell* closed. *pterostigma* and *veins* very pale yellow.

*Long.* 2.2 mm.

Type in Brit. Mus.

One winged ♀. Egypt: Siwa. 17. vii. 35 (*J. Omer-Cooper*).

Possibly this small species has parasitic habits.

#### Subfamily FORMICINÆ Lepeletier.

##### Tribe PLAGIOLEPIDINI Forel.

17. *Plagiolepis pullescens* Forel, subsp. *maura* Santschi, Bull. Soc. Vaud. Sci. Nat. liii. p. 169 (1920).

One ♂, one deãlated ♀, 75 ♀♀. Egypt: ♂ and ♀, Kamissa, 22. vi. 35; ♀♀, Kamissa, Siwa, Gara, vi., vii., viii. 35 (*J. Omer-Cooper*).

Recorded distribution: Tunis to Morocco.

18. *Plagiolepis pullescens* Forel, subsp. *maura* Santschi, var. *sordida* Santschi, Bull. Soc. Vaud. Sci. Nat. liii. p. 170 (1920).

Seventeen ♀♀. Egypt: Siwa. Zeitoun, Kamissa, vi., vii., viii. (*J. Omer-Cooper*).

Recorded distribution: Tunis to Morocco.

19. *Acantholepis frauenfeldi* Mayr, var. *variabilis* Santschi, Bull. Soc. Hist. Nat. Africa Nord, viii. pp. 43, 46 (1917).

Three ♀♀. Egypt: Siwa, 21. viii. 35; Khamissa, 27. viii. 35 (*J. Omer-Cooper*).

Recorded distribution: Tunis, Cyrenaica.

20. *Acantholepis frauenfeldi* Mayr., subsp. *saharensis* Santschi, Bull. Soc. Hist. Nat. Africa Nord, viii. pp. 44, 47 (1917).

Six ♀♀. Egypt: Siwa, vi., vii., viii. 35 (*J. Omer-Cooper*).

Recorded distribution: Algeria, Touggourt.

### Tribe CAMPONOTINI Forel.

21. *Camponotus (Tanæmyrmex) maculatus* F., subsp. *ægyptiaca* Emery.

Twenty-eight ♂♂, one deãlated ♀, numerous ♀♀ and ♂♂. Egypt: ♀, Siwa, 28. viii. 35; ♂♂, Siwa, vi., vii., viii. 35, ♀♀ and ♂♂, Siwa, Gara, Jajub, Khamissa, vi., vii., viii. 35 (*J. Omer-Cooper*).

Recorded distribution: Egypt and the Basin of the Nile.

22. *Camponotus (Tanæmyrmex) compressus* F., subsp. *thoracica* F., Syst. Piez. p. 397 (1804).

Twenty-two ♂♂, one deãlated ♀, thirty-three ♀♀ and ♂♂. Egypt: Siwa, ♀, 28. viii. 35; ♂♂, vii., viii. 35; ♀♀ and ♂♂, vii., viii., ix. 35 (*J. Omer-Cooper*).

Recorded distribution: Algeria and Tunis; inhabits oases in sandy deserts.

23. *Camponotus (Orthonotomyrmex) sericeus* F., Suppl. Ent. Syst. p. 279 (1798).

Two ♂♂, two deãlated ♀♀, seven winged ♀♀, thirty-four ♀♀. Egypt: deãlated ♀♀, Gara, 4. vii. 35; winged ♀♀, Siwa, 30. vi. 35, 6. viii. 35; ♂♂, Siwa, vii., viii., 35; ♀♀, Siwa, Koreishad, vi., vii., viii. 35 (*J. Omer-Cooper*).

### Tribe LASIINI Ashmead.

24. *Paratrechina (Nylanderia) jæggerskjöldi* Mayr., var. *borcardi* Santschi, Ann. Soc. Ent. France, lxxvii. p. 533 (1908).

Thirty-three ♂♂, nine winged ♀♀, twenty-three ♀♀. Egypt: Siwa, Maragi, Kamissa, Tenterad, vi., vii., viii. 35 (*J. Omer-Cooper*).

Recorded distribution: Egypt, Syria, Cyprus.

Tribe FORMICINI Forel.

25. *Cataglyphis (Cataglyphis) albicans* Roger, Berlin Ent. Zeitschr. iii. p. 235 (1859).

One ♀. Egypt : Siwa, 30. vi. 35 (*J. Omer-Cooper*).

Recorded distribution : Tunis, Algeria.

26. *Cataglyphis (Cataglyphis) bicolor* F., Ent. Syst. ii. p. 35 (1793).

One ♀. Egypt : Koreishid (*J. Omer-Cooper*).

Recorded distribution : Africa north, Syria.

27. *Cataglyphis (Machaeromyrma) bombycina* Roger, Berlin, Ent. Zeitschr. iii. p. 232 (1859).

Twenty 44, sixty-eight ♂♂. Egypt : Siwa, vii., viii. (*J. Omer-Cooper*).

Some of the soldiers are very large with well-developed jaws. This is the only species of *Cataglyphis* which possesses a soldier form.

Recorded distribution : inhabits deserts in Egypt and the north of Africa in general.

III.—*New Species of Chrysomelidæ (Coleoptera) from Borneo and New Guinea.* By G. E. BRYANT, F.R.E.S. (Imperial Institute of Entomology).

THE genus *Liprus* Mots., 1860 (Halticiniæ), has a range from Japan to New Guinea, including India, China, Singapore, Java, Borneo, and Sumatra. It appears to be rare, and evidently needs special collecting, as the thirteen species contained in the British Museum collection are represented by few specimens. It is very closely allied to *Alema* Sharp, from New Zealand. All the types of the new species here described are in the British Museum.

*Liprus assamensis* Mlk., Fauna Brit. Ind. 1926, p. 131. Assam.

*Liprus borneensis*, sp. n. Sarawak.

*Liprus cheesmanæ*, sp. n. New Guinea.

*Liprus difficilis* Chen., Sinensia 5, 1934, p. 264. Tonkin.

*Liprus flavilabris* Jac., Trans. Ent. Soc. Lond. 1893, p. 154. Java.



- Liprus fulvoniger* Mlk., Fauna Brit. Ind. 1926, p. 132. Burma.
- Liprus hirtus* Baly., Trans. Ent. Soc. Lond. 1874, p. 194. Japan.
- Liprus longicollis* Jac., Ann. Soc. Ent. Belg. 1898, p. 376. Borneo.
- Liprus malayanus* Jac., Ann. Mus. Civ. Gen., 2nd ser., ii. 1885, p. 71. Sumatra.
- Liprus montanus* Chujo, Trans. N. H. Soc. Form. 25, 1935, p. 396. Japan.
- Liprus nigrinus* Jac., P. Z. S. 1885, p. 724. Japan.
- Liprus nitidus*, sp. n. Sarawak.
- Liprus obscurus* Chen., Bull. Mus. Paris, 1933, p. 382. India.
- Liprus punctato-striatus* Mots., Etud. Ent. 1860, p. 26. Japan.
- Liprus quadrimaculatus*, sp. n. New Guinea.
- Liprus rugosus*, sp. n. New Guinea.
- Liprus suturalis* Jac., P. Z. S. 1885, p. 725. Japan.

### Key to the Species.

- |  |                                |
|--|--------------------------------|
| 1 (11). Entirely dull black.                                   |                                |
| 2 (35). Elytra not metallic.                                   |                                |
| 3 (5). Legs black.   |                                |
| 4 (8). Prothorax subquadrate .....                             | <i>punctato-striatus</i> Mots. |
| 5 (3). Legs flavous .....                                      | <i>nigrinus</i> Jac.           |
| 6 (10). Legs dark, with the tarsi fulvous.                     |                                |
| 7 (9). Prothorax strongly punctured .....                      | <i>rugosus</i> , sp. n.        |
| 8 (4). Prothorax strongly constricted at the base.             |                                |
| 9 (7). Prothorax impunctate.                                   |                                |
| 10 (6). Legs with the posterior femora fuscous.                | <i>flavilabris</i> Jac.        |
| 11 (1). Entirely deep chestnut-brown.                          |                                |
| 12 (19). Not entirely deep chestnut-brown.                     |                                |
| 13 (18). Prothorax impunctate .....                            | <i>longicollis</i> Jac.        |
| 14 (17). Antennæ with the segments 3-5 light brown.            |                                |
| 15 (16). Elytra with the punctures confused ..                 | <i>aseamensis</i> Mlk.         |
| 16 (15). Elytra with regular punctures.                        |                                |
| 17 (14). Antennæ with the terminal segment dark brown .....    | <i>difficilis</i> Chen.        |
| 18 (13). Prothorax with shallow punctures ..                   | <i>montanus</i> Chujo.         |
| 19 (12). Entirely pale brown.                                  |                                |
| 20 (25). Not entirely pale brown.                              |                                |
| 21 (24). Elytra with the intervals costate between the striae. |                                |
| 22 (23). Punctures on the elytral striae very close .....      | <i>malayanus</i> Jac.          |
| 23 (22). Punctures on the elytral striae not close .....       | <i>nitidus</i> , sp. n.        |

- 24 (21). Elytra with the interspaces of the  
striæ smooth ..... *hirtus* Baly, ♂.  
25 (20). Pale brown, with markings on the  
elytra.  
26 (27). Elytra with the suture black..... *naturalis* Jac.  
27 (26). Elytra with black maculæ ..... *quadrimaculatus*, sp. n.  
28 (36). Prothorax red, elytra black.  
29 (31). Elytra black, strongly punctate-striate.  
30 (34). Legs fulvous ..... *hirtus* Baly, ♀.  
31 (29). Elytra with bluish tinge, feebly punctate-striate.  
32 (33). Antennæ entirely fulvous..... *fulvoniger* Milk.  
33 (32). Antennæ with the five terminal segments dark ..... *obscurus* Chen.  
34 (30). Posterior femora fuscous, the seven terminal segments of antennæ tinged with fuscous ..... *borneensis*, sp. n.  
35 (2). Elytra metallic.  
36 (38). Prothorax dark, elytra coppery ..... *cheesmanæ*, sp. n.

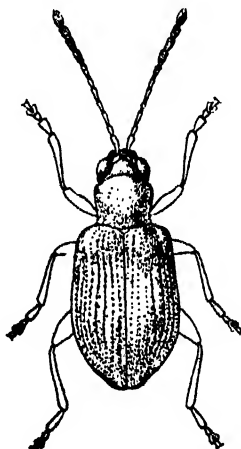
*HALTICINÆ.*

*Liprus rugosus*, sp. n. (Fig. 1.)

Black, with the six basal segments of the antennæ and the tarsi fulvous, head impunctate, prothorax strongly punctured, the elytra punctate-striate.

Length 2 mm.

Fig. 1.



*Liprus rugosus*, sp. n.

Head black, impunctate, a triangular impression between the eyes. Antennæ extending slightly beyond the middle

of the elytra, the six basal segments fulvous, the four terminal segments black, the basal segment the longest, thickened and club-shaped, the second and third about equal, each shorter than the first, the second slightly more swollen than the third, the fourth a very little shorter than the third, the fifth a little longer than the sixth, seventh to the eleventh all about equal, each a little longer than the sixth. Prothorax black, about as broad as long, the sides slightly contracted towards the base, a transverse impression near the base, strongly and rugosely punctured. Scutellum black, triangular, impunctate. Elytra black, oblong, rounded at the apex, a transverse depression behind the base, strongly punctate-striate, the intervals slightly costate. Legs black, with the tarsi fulvous. Male with the first segment of the anterior tarsi dilated. Underside black.

NEW GUINEA: Mt. Tafa, 8500 ft., ii. 1934 (*Miss L. E. Cheesman*).

Somewhat allied to *L. nigritus* Jac., from Japan, on account of its subquadrate prothorax, but much smaller and more strongly punctured.

*Liprus nitidus*, sp. n. (Fig. 2.)

Entirely shining golden-brown, the antennæ and legs slightly lighter, the elytra punctate-striate, the intervals feebly costate.

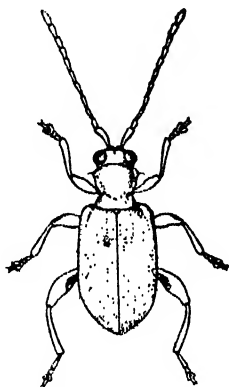
Length 2 mm.

Head golden-brown, impunctate, nitid, a short median transverse impression behind the insertion of the antennæ, eyes large and prominent. Antennæ extending beyond the middle of the elytra, pale golden-brown, the first segment the longest and slightly club-shaped, the second much shorter and slightly thickened, the third a little longer than the second, and more or less equal to each of the following, the apical segment sharply pointed. Prothorax golden-brown, very nitid and impunctate, longer than broad, the sides strongly constricted before the base, with a transverse impression before the base. Scutellum triangular, impunctate. Elytra golden-brown, broader at the base than the base of the prothorax, the sides parallel and behind the middle tapering to the apex, punctate-striate, the intervals feebly costate, and the punctures not close and regular, clothed with fine golden pubescence, transversely depressed behind the shoulders.

Legs slightly paler and clothed with fine golden pubescence. Underside golden-brown.

W. SARAWAK: Mt. Matang, ii. 1914 (*G. E. Bryant*), 1 specimen.

Fig. 2.



*Liprus nitidus*, sp. n.

Allied to *L. malayanus* Jac., but differs in being slightly smaller, much more nitid, and the punctures on the elytra much coarser and not so close and regular; also differs in the colour of the antennæ.

*Liprus quadrimaculatus*, sp. n. (Fig. 3.)

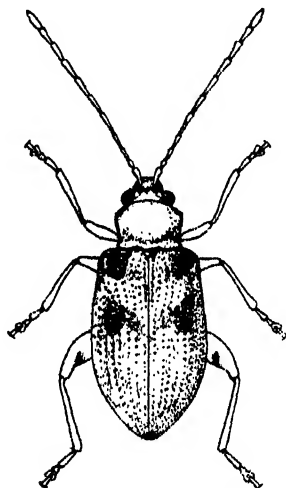
Entirely flavous, except for the base of the elytra, which has four irregular maculæ on the basal third inside the humerus, in one specimen joined in an oblong patch, head impunctate, prothorax strongly punctured, the elytra strongly punctate-striate, clothed with fine short golden pubescence.

Length 3 mm.

Head flavous, nitid, impunctate, a feeble longitudinal carina between the base of the antennæ. Antennæ flavous, rather long and slender, extending beyond the middle of the elytra, the first segment long and club-shaped, the second much shorter, somewhat thicker than the third, the third and fourth a little longer than the second and about equal, the fifth longer than the fourth, the fifth to the eleventh all about equal, clothed with short fine pubescence. Prothorax flavous, subquadrate,

contracted at the base with a transverse basal depression, strongly but closely punctured. Scutellum flavous, nitid, impunctate. Elytra flavous, with four black maculæ on the basal third inside the humerus, the sides parallel and rounded at the apex, strongly punctate-striate, the sides slightly costate, clothed with very fine short golden pubescence. Legs flavous, the hind femora

Fig. 3.

*Liprus quadrimaculatus*, sp. n.

slightly more incrassate. Underside flavous, nitid, the first ventral segment very long, the second to the fourth short and about equal to each other.

NEW GUINEA: Tafa, 8500 ft., ii. 1934 (*Miss L. E. Cheesman*), 3 specimens.

A large species, unlike any other described species on account of the maculate elytra. Superficially very like *Alema spatiosa* Broun, from New Zealand.

*Liprus borneensis*, sp. n. (Fig. 4.)

Head, prothorax and legs golden-brown, the seven terminal segments of the antennæ and the posterior femora tinged with fuscous, the elytra and abdomen black, clothed with rather long golden pubescence.

Length 2.5 mm.

Head golden-brown, impunctate, a transverse median impression between the eyes, the vertex convex. Antennæ long and slender, extending almost to the apex of the elytra, the first segment long and club-shaped, the four basal segments fulvous, the seven terminal fuscous, the second and third each much shorter than the first and about equal, the fourth a little longer than the third, the fourth to the apical segment all about equal and slender. Prothorax golden-brown, finely but not closely punctured, clothed with scattered golden pubes-

Fig. 4.

*Lipus borneensis*, sp. n.

cence, longer than broad, the sides constricted in front of the base, connected by a transverse impression. Scutellum triangular, impunctate. Elytra much broader at the base than the prothorax, black, strongly punctate-striate, the intervals between the striæ costate; transversely impressed behind the base. Legs golden-brown, the posterior femora tinged with fuscous, all clothed with fine golden pubescence, the posterior tibiæ slightly curved. Underside with the abdomen black.

W. SARAWAK: Mt. Matang, 19. i. 1914 (*G. E. Bryant*), 1 specimen.

Allied to *L. hirtus* Baly, but the prothorax with the sides more strongly constricted, and the punctuation of the elytra stronger and more costate.

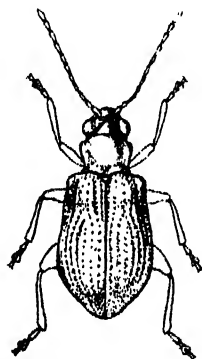
*Liprus cheesmanæ*, sp. n. (Fig. 5.)

Shining black, the elytra cupreous, antennæ and legs flavous, the hind femora fuscous. Head impunctate, prothorax with a few strong punctures near the anterior angles, elytra strongly punctate-striate, costate at the sides.

Length 2 mm.

Head prominent, black, nitid, impunctate, eyes ovate, triangularly impressed between the eyes. Antennæ

Fig. 5.



*Liprus cheesmanæ*, sp. n.

extending to the middle of the elytra, flavous, the two basal segments more swollen, the first the longest, the third to the sixth about equal to each other, and about equal to the second, the seventh to the eleventh each a little longer than the sixth, slightly thickened and pubescent. Prothorax black, nitid, subcylindrical, transversely grooved and constricted in the front of the basal margin, strongly, but not closely punctured near the anterior angles, and a few punctures in the transverse groove. Scutellum black, nitid, impunctate. Elytra cupreous, much broader than the base of the prothorax, oblong, convex, widest a little behind the middle, strongly punctate-striate, the sides strongly costate, the humeral

callus elevated, somewhat broadly depressed near the base. Legs flavous, the posterior femora tinged with fuscous. Underside black, nitid.

NEW GUINEA: Mt. Tafa, 8500 ft., ii. 1934 (*Miss L. E. Cheesman*), 2 specimens.

Allied to *L. assamensis* Mlk., smaller, and easily distinguished from all the described species on account of its metallic colour.

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#### IV.—New Pleistocene Murinæ from Crete.

By DOROTHEA M. A. BATE.

SOME years ago it was mentioned that remains of *Rattus rattus* and of an *Acomys* had been found in the Pleistocene of Crete (Bate, 1912, p. 6). Recently a more detailed examination and development of the specimens has been made, with the result that both records have to be revised. The *Rattus* proves to be a distinct species, less specialized than European *Rattus* of the present day, and the so-called *Acomys* is now found to be a distinct species of *Mus*, less specialized than Recent species.

The Cretan fossils are of considerable interest and importance since almost nothing is known of the immediate ancestry of either *Rattus* or *Mus*, while, with one exception, no species representing these two genera has previously been described from the Pleistocene of any of the Mediterranean Islands. The one exception is the large murine (?) *Mus catreus*, also from Crete, whose close affinities are likely to remain obscure until further specimens are obtained. Descriptions of the new species are given below.

*Rattus kiridus* \*, sp. n. (Fig. 1, a & b.)

*Diagnosis*.—A *Rattus* about the size of *R. norvegicus*. Zygomatic plate not thrust far forward as generally in Recent *Rattus*; distance from anterior border of alveolus of  $M^1$  to anterior basal angle of zygomatic plate very short, equalling about two-thirds of the length of  $M^1$ ; anterior ascending border of plate slightly receding, posterior border short, anterior base of plate unusually

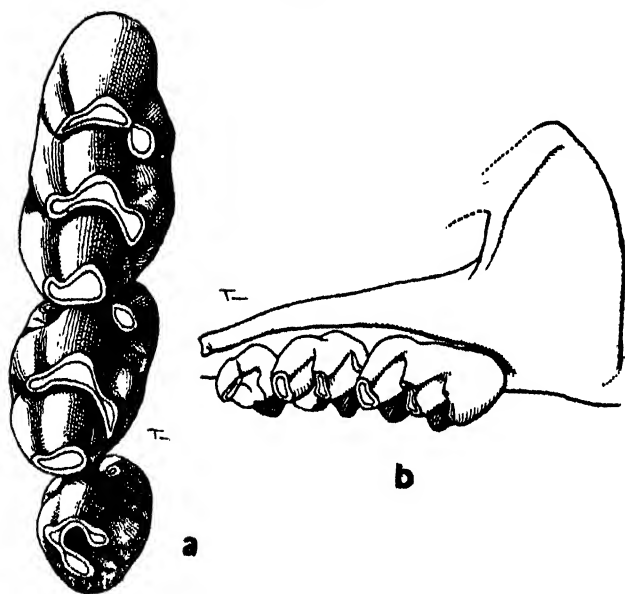
\* From Kirid, Turkish for Crete.



low. Cheek-teeth narrow,  $M^1$  three-rooted, internal tubercles not strongly salient, anterior root not projecting forwards above the alveolar border.  $i3^*$  is present in  $M^2$ ; the maximum length of  $M^2$  is about half that of  $M^1$ .

*Holotype*.—A right maxilla with the three cheek-teeth and the zygomatic plate. Brit. Mus., M 10555 (fig. 1, a & b).

Fig. 1.



*Rattus kiridus*, sp. n., holotype.

a. Crown view of upper cheek-teeth.  $\times 10$ .

b. Side view of zygomatic plate and tooth row.

*Horizon and Distribution*.—Pleistocene: Island of Crete. Holotype and an isolated  $M^2$  and  $M_1$  from an ossiferous deposit at Cape Maleka, Western Crete (Bate, 1905, p. 195); associated with remains of the dwarf elephant, *E. creticus*.

*Description and Comparisons*.—The upper cheek-teeth of *R. kiridus* are rather more like those of *R. rattus* than

\* For numbers of tubercles, see Miller, 1912, p. 801.

of *R. norvegicus*, but they evidence a lesser degree of specialization in the presence of  $t3$  in  $M^2$  and  $M^3$  and by the complete inclusion of the anterior root of  $M^1$  inside the alveolar cavity. When we turn to the area of the zygomatic plate (fig. 1, *b*) the difference between the fossil and the Recent European forms is most marked. Comparison was made with many species of *Rattus* and allied genera not only from Europe, but also from Africa and Asia, but it was not until some large far eastern forms, particularly *R. edwardsi* from W. Fokien, China, were examined, that a somewhat similar skull condition was found.

In *R. rattus*, *R. norvegicus*, and indeed in the majority of Recent species of *Rattus*, as well as in Recent *Mastomys*, the zygomatic plate is thrust far forward with its posterior border usually in advance of  $M^1$ . This results in the distance between the anterior basal root of the zygomatic plate and the anterior border of the alveolus of  $M^1$  being greater than the length of  $M^1$ , and very generally equalling that of  $M^1$  and half that of  $M^2$  combined. The position of the zygomatic plate in *R. kiridus* and *R. edwardsi* is very different, for it is not thrown nearly so far forward, and its posterior base has its origin in line with the first lamina of  $M^1$ . The resulting distance between the basal root of the zygomatic plate and the anterior border of the alveolus of  $M^1$  equals less than the length of  $M^1$ ; in the holotype of *R. edwardsi* this measurement is five-sixths of the length, while in *R. kiridus* it only equals the length of the first and second laminae of  $M^1$ , that is about two-thirds of the length of the tooth. In the fossil the width of the zygomatic plate is 4 mm., its anterior base is low, and the anterior border slopes gently backwards as it ascends; the plate lies close to the skull, differing from its rather outspread position in *R. rattus*. The length of the upper cheek-tooth row in *R. kiridus* is 7 mm., of which half is occupied by  $M^1$ ;  $M^1$  has three roots, while four appear to be the number in *R. edwardsi*.  $M^3$  is comparatively shorter in the Cretan specimen than it is in Recent *R. rattus*.

*Remarks.*—The rather startling resemblance between the skull of the fossil *R. kiridus*, so far as it is known, and that of the Recent *R. edwardsi* is not brought forward as a basis for suggesting that a close relationship exists

between these two species which are so widely separated both in time and space. What it does seem legitimate to suggest is that, at least in this particular character, the skulls of these species represent a similar stage of development. This will not seem so unlikely when the status of *R. edwardsi* and its near allies is investigated. Dr. Tate has written (1936, p. 512) "... that doubt that Southern Asia represents the distributional centre and land of origin of *Rattus* can scarcely be entertained." There can be little doubt that *R. edwardsi* and its close allies are survival forms specialized in certain characters; these large rats are all mountain dwellers, ranging from 1400 ft. (*R. e. garonum*) to 5000 ft. (*R. e. milleti*). In his original description of *R. edwardsi*, Mr. Oldfield Thomas writes (1882) "All the specimens were obtained by Père David in October, 1873, in Western Fokien, and were found among the rocks in high mountains. He states that this Rat does not burrow at all," and it has specialized feet and other peculiar characters. Later the same author recorded (Thomas, 1921, p. 27) that the distribution area of this species extends westwards into the high mountainous Kachin region of Burma.

*Fossil Record.*—Practically nothing is known of the fossil history of the genus *Rattus*. The only records, other than the present one, from the Mediterranean area are not satisfactory; as already mentioned, *R. kiridus* was originally referred to *R. rattus* (Bate, 1912, p. 6), there is a doubtful record from Gibraltar (Busk, 1868, p. 151) and another from Malta (Bate, 1920, p. 209). *R. rattus* has been listed from a cave deposit in Palestine, based on a single mandibular ramus (Bate, 1927, p. 28).

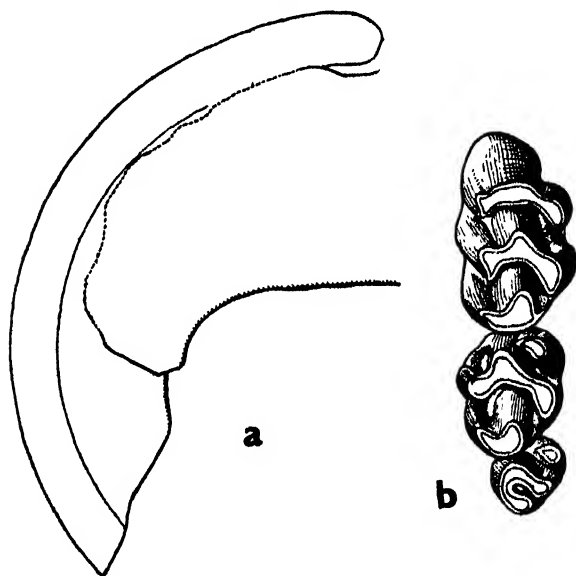
It is not surprising to learn that numerous finds of fossil remains of *Rattus* have recently been made in various parts of China, including several different horizons of Choukoutien (see Young, 1934, pp. 77-79; Pei, 1936, p. 65; Teilhard, 1938, p. 19). No skulls have yet been described, but Father Teilhard mentions the discovery of several which he says represent a distinct species from a (?) Villafranchian deposit in the Mentoukou Valley between Peking and Choukoutien.

An extinct species of the allied genus *Mastomys* has been described from the Siwalik series (Nagri formation) of India (Lewis, 1939).

*Mus minotaurus*, sp. n. (Fig. 2, a & b.)

**Diagnosis.**—A *Mus* of large size, equalling in size the largest Recent representatives of the *Mus* group. Bony knob present at anterior root of zygomatic plate, maxilla immediately in front of the upper tooth row wide and massive. Zygomatic plate not thrust far forward, making the distance between its anterior root and the anterior border of the alveolus of  $M^1$  short, less than the

Fig. 2.

*Mus minotaurus*, sp. n.

a. External view of left upper incisor.  $\times 10$ .

b. Crown view of upper cheek-teeth, holotype.  $\times 10$ .

(In the original  $\delta 1$  of  $M^1$  is rather more backwardly situated.)

crown length of  $M^1$ . Anterior palatine foramina broad anteriorly, penetrating posteriorly to in line with between the inner tubercles of  $M^1$ . Mandibular ramus stout and comparatively short in front of the cheek-tooth row. Upper incisors short, orthodont, with curve of tooth wider than in Recent *Mus*, perhaps a slight notch on outer cutting-edge, outer surface rounded with enamel

band noticeably wide, antero-posterior diameter one-and-a-half times greater than the transverse diameter.  $M^1$  three-rooted, anterior root not projecting beyond crown and concealed in alveolus, crown length greater than that of  $M^{2-3}$  combined, but less so than is usual in Recent wild *Mus*;  $t1$  is less backwardly placed and  $t3$  more strongly developed than in *M. gentilis*.  $t3$  of  $M^2$  may be present or not, size and crown-pattern of  $M^3$  about as in Recent *Mus*.

*Holotype*.—An imperfect right maxilla with the three cheek-teeth, Brit. Mus. M 15950 (fig. 2, *b*).

*Horizon and Distribution*.—Pleistocene: Island of Crete, holotype and a few isolated teeth, including an upper incisor, Brit. Mus. M 15951 (fig. 2, *a*), from a cave deposit in a small limestone ridge between Canea and Suda. These were associated with remains of ungulates and a shrew (Bate, 1905, p. 194). An isolated upper incisor from the elephant deposit at Cape Maleka may also represent this species.

*Description and Comparisons*.—Besides the holotype and the figured upper incisor a few more specimens have been developed from a small piece of matrix from the same locality, and include the anterior portion of a ramus with the incisor and a broken  $M_2$ , an upper incisor and several isolated cheek-teeth. That *Mus minotaurus* is a more primitive species than Recent wild forms is shown by the various characters mentioned in the diagnosis, and also by the more upright position of the tubercles of  $M^1$  and the absence of the extreme lateral compression of the upper incisor. The absence of a deep notch in the outer cutting-edge of this tooth, generally characteristic of Recent *Mus*, is a condition almost the same as that seen in the holotype of *M. spretus*, from Algeria, in the British Museum Collection. It is worth mentioning that this notch may be present or not, or only slightly developed among the various forms of *Leggadilla*. The antero-posterior diameter of the figured upper incisor is 1.6 mm., and that of a lower incisor is 1.3 mm., the exposed anterior surface of the upper tooth is rounded and slopes gently from its inner to its outer border, lacking the flattened area seen in Recent *Mus*, *Leggadilla*, and *Mastomys*. The upper incisor is much shorter, and its place of origin is much higher and more forwardly situated than in Recent *Mus*.

In *M. minotaurus* holotype, the length of the tooth row is 4.5 mm., of which  $M^1$  occupies 2.4 mm., and  $M^{2-3}$  2.1 mm. In the figure  $t1$  of  $M^1$  does not project backwards quite as far as in the specimen.  $t3$  of  $M^2$  is represented by a slight ridge, but this condition is not invariable, for among four isolated examples from the same deposit two resemble the figured tooth while the other two each have a well developed  $t3$ . The reduction of  $M^3$  is about the same as that found in *M. spicelegus hispanicus*, *M. spretus*, *M. wagneri mongolicum*, etc., while there are other forms of Recent *Mus* in which this has gone considerably further. While *M. minotaurus* is a large species, it is equalled in size by *Leggadilla shorridgei* and *L. hanningtoni* from Burma and India.

*Fossil Record.*—Fossil records of *Mus* as now restricted are rare. Some jaws of *M. musculus* from a cave in the Kerynia Hills, Cyprus, are in the British Museum (M 8634), but these are of modern type, with  $M^{2-3}$  more reduced in length compared with  $M^1$  than in *M. minotaurus*, and their state of preservation suggests a comparatively recent origin. De Gregorio (1887, p. 247) noticed some remains from a Pleistocene deposit near Palermo, Sicily, under the name *Mus piletus*, but it seems that these really represent *Leithia*, for some years later the same author writes "*Myoxus melitensis* Adams (var. *piletus* De Greg.)" (de Gregorio, 1925, p. 17).

Outside the Mediterranean area Dr. C. C. Young (1934, p. 79, fig. 29) has described *M. musculus bieni* from Choukoutien, Locs. 1 and 2, which is a small form known only from a number of mandibular rami. *M. musculus* has been recorded from Loc. 3 (Pei, 1936, p. 66) and Loc. 15 (Pei, 1939, p. 153).

*Conclusion.*—That each of the two extinct species described above, which belong to different though allied genera, should exhibit a similar stage of development in the position of the zygomatic plate, a less specialized condition than is generally found in Recent forms, is of considerable interest, not only as illustrating a stage in their history, but also as showing that these two genera developing on divergent lines still preserve characteristic trends in common. Somewhat similar instances have been observed during a study of the Pleistocene micro-mammalia of Palestine, for instance in species of *Crocidura*, *Talpa*, etc. (Bate, 1937).

*Rattus kiridus* and *Mus minotaurus* belong to a Pleistocene fauna of Crete which is composed of extinct species, and has no close relationship with the island fauna of the present day. It is not yet possible to date this fauna closely, but it may be claimed that it flourished prior to the widespread faunal change which took place in Palestine between Lower and Upper Levallois-Mousterian times (Bate, 1937, chart facing p. 156). In Crete to-day no *Rattus* or *Mus* is found except in the port towns, which have doubtless been reached through human agency (Bate, 1906, p. 321); wild murines are represented in the island by *Apodemus sylvaticus creticus* Miller and *Acomys minous* Bate.

No doubt other species will be discovered when further excavations are undertaken. Admiral Spratt mentioned the occurrence of *Myoxus* in the Gonia cave in the west, but I have no confirmation of this, although fragmentary rodent remains were noticed at this site, and also in the cave of Kharoumes in the far east of the island.

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V.—On *Girvanella* in the "Shumardia Limestone" of Lévis, Quebec. By Professor H. P. LEWIS, M.A., Sc.D., F.G.S., University College of Wales, Aberystwyth.

[Plate 1.]

DURING a visit to Canada in 1931\*, I made a small collection of fossils from the famous section of Lower Ordovician rocks at Lévis, Quebec, and particularly from the "Shumardia Limestone," which occurs near the top of the section of Lévis Shales. Specimens of this limestone, containing *Shumardia granulosa* Billings and other characteristic fossils, have been sectioned and examined for microfossils. Every slide so far prepared has shown the presence of the organism *Girvanella*, now usually regarded as a calcareous alga (9). The record seems to be worthy of notice because, so far as I am aware, no calcareous algæ have been recorded from the Lévis Series; neither Raymond (10, 11) nor Clark (1) referring to their presence in the succession. Dawson, in 1896, mentioned *Girvanella antiqua* as a new species obtained by him from a boulder of Cambrian, or possibly Lower Ordovician, age in a conglomerate at Little Metis, Quebec (2). Calcareous algæ of *Cryptozoon* type are well known in the Beekmantown limestones and *Girvanella ocellata* (Seely) occurs commonly in the Chazy limestones at various localities in eastern North America.

Little attention seems to have been given in America to the microstructure of *Girvanella* since Seely described

\* A grant from the J. B. Tyrrell Fund of the Geological Society of London, which made this visit possible, is gratefully acknowledged.



several species from the Chazy under the synonym "*Strephochetus*," and even Seely based his distinctions between species very largely on the size and form of the nodules built up by the algal growths (14). It would appear to be a common practice in American stratigraphical work to classify algal nodules of large size (or showing columnar structure) as *Cryptozoon* spp. and small globular ones as species of *Girvanella*, without reference to the microstructure in each case (12). In the present paper, therefore, it has been thought advisable to deal with the general and special features of the fossil in some detail, and to draw comparisons with forms of *Girvanella* found in Ordovician rocks of other areas. The classification followed here is that of Pia (9).

#### AGATHIDIA, Pia.

##### GIRVANELLA, Nicholson and Etheridge.

##### *Girvanella problematica* var. *spiralis*, nov. (Pl. I. figs. 1-8.)

*Genotype*.—*Girvanella problematica* Nich. and Etheridge, Mon. Siln. Foss. Girvan Dist., 1878, p. 23, pl. ix, fig. 24.

*Holotype*.—Slide no. V. 26831, Dept. of Geology, British Museum (Natural History). Pl. I. fig. 7.

*Distribution*.—"Shumardia Limestone," zone D<sub>1</sub> of Raymond (and Clark), Lévis Shales, Ordovician. Cliff behind the Fonderie de Lévis, Lévis, Quebec.

*Diagnosis*.—*Girvanella problematica*, in which some filaments manifest a tendency to become arranged in a helix with the whorls in contact.

*Description*.—The filaments or tubes of the fossil vary in length, thickness and curvature. They show recurvature in places, but branching has not been detected. Individual filaments maintain a constant width, but in different colonies they often vary in thickness from 11  $\mu$  to 25  $\mu$ . The usual diameter is between 13  $\mu$  and 17  $\mu$ . In general, singly occurring tubes have a greater width than those which are massed together.

The fossil shows several different modes of aggregation or habits of growth. These, however, merge into one another and are not rigidly separable from one another or typically confined to any one colony or collection of

filaments. For convenience of description the following forms or arrangements of the tubes may be distinguished :—

(a) Single, isolated filaments, or portions of filaments, either straight or flexed, curved or recurved and, in some instances coiled to form a plane spiral.

(b) Small numbers of filaments, usually two to four, arranged as parallel or slightly entwining or intertwining strands.

(c) Aggregates of irregularly interlaced filaments, more or less loosely compacted and forming either elongate masses, or bundles at the extremities of form " e."

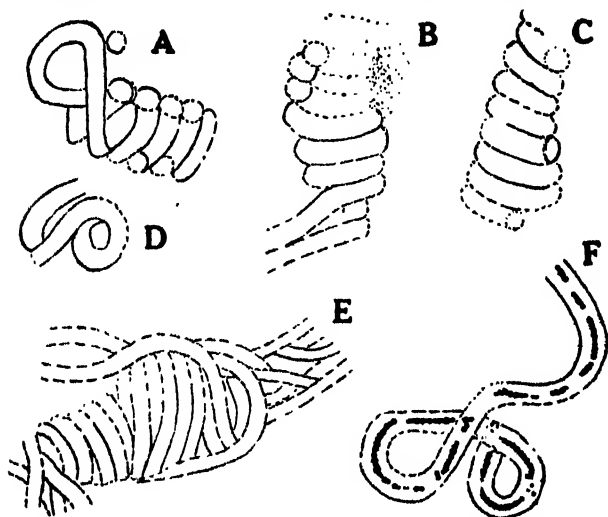
(d) Numbers of parallel but often flexed filaments lying in contact, and mainly in one plane so as to form a thin lamella.

(e) Filaments arranged in helices and so forming elongate, cylindrical or fusiform bodies, or incrustations, of screw-like aspect. This is the characteristic form of the variety *G. spiralis*. It may have originated by the twining of one or more filaments, in spiral fashion, with the whorls in contact, around a more or less rigid nucleus (see text-figs.). The nucleus is now represented in every case by clear crystalline calcite, and its original nature is unknown.

All these forms are so closely associated in the limestone that they may all appear in one microslide. There can be little doubt that they merely represent variations in the mode of aggregation of the filaments of the variety *G. spiralis* or, at most, of the species *G. problematica*.

*Minute texture.*—The tubes of *G. spiralis* differ in their minute texture according to the variation in the degree and nature of the recrystallisation of the limestone containing them. No vestige has been seen of the thin original organic walls of the algal cells, but some of the better-preserved tubes exhibit a wall-like structure, composed of calcite, with clearly defined outer and inner boundaries, which are visible in both longitudinal and transverse sections of the tubes. The walls, when best defined, have a thickness of  $2\mu$  to  $3\mu$ . Scattered throughout the slides occur straight or slightly curved tubes of the dimensions of those of *G. spiralis*, and in some of these the calcite walls have been partly replaced by silica,

and enclose a central "canal" filled with calcite. Further evidence to indicate the essentially tubular nature of the original structure is provided by the occurrence in one instance of a string of granules of hæmatite within the walls of a looped algal filament, and suggesting either a later infilling of the original middle portion of the tube, or replacement of the original material which occupied this position and which must have been distinct in some of its characters from the material composing the outer



Outline diagrams of forms of *G. problematica* var. *spiralis*, nov.

A to E. Regularly and irregularly coiled tubes. F. Looped tube containing medial string of hæmatite globules. A-D and F, slide no. V. 26830; E, slide no. V. 26831. Magnification in each case about 150 times the original size.

walls (see text-fig. F). According to Wood (16), such wall-like structures in *G. problematica* and other filamentous calcareous algae, are to be interpreted as coatings of "algal-dust" which surround the tubes originally occupied by the algal filaments, so that the "algæ are preserved as moulds in a fine-grained calcareous matrix precipitated by their own life processes."

*Comparisons.*—It is difficult to find any features of specific importance within the genus *Girvanella* by which to discriminate between the various irregularly or loosely constructed masses and concentrically layered nodules of this fossil, which is now known to be represented in every

stratigraphical system from the Cambrian to the Cretaceous, both inclusive. So far as the Ordovician species are concerned, the European forms are all variants of *G. problematica*, while those in America can be similarly assigned to *G. (Strephochetus) ocellata* (Seely). Judging from Seely's figures, the resemblances between *G. ocellata* and *G. problematica* far outweigh any differences, and, in my opinion, the two species are synonymous, *G. ocellata* being no other than *G. problematica* with narrow tubes. *G. ocellata* and its variants have tube-widths of about  $13\mu$ , corresponding to the narrower forms of *G. problematica* var. *spiralis*. Nicholson gave  $17\mu$  to  $40\mu$  as the range in tube-width of *G. problematica*, with  $22\mu$  as the common size (7); while, for Norwegian forms of this species, Høeg (5) has recently found tube-widths ranging from  $14\mu$  to  $26\mu$  and rarely  $30\mu$ . It is obvious, therefore, that the range of variation in tube-width in *G. problematica* is such that it can certainly be extended to include *G. ocellata* and its variants.

Høeg has described three forms of *G. problematica* from the Ordovician Kalstad Limestone of the Trondheim district of Norway. His description, of these forms suggest that they are closely similar to the fossil from Lévis, both in the dimensions and attitudes of the filaments. His forma *typica* consists almost wholly of algal tubes arranged parallel to one another or twisted together, and with tube-diameter about  $16\mu$  to  $20\mu$ . This corresponds to the arrangement described above under "c." Forma *lumbricalis* of Høeg includes tubes occurring separately, curved, flexuous, sometimes running parallel or twisted around each other, but usually only irregularly interlaced or completely isolated. The tube-width is  $14\mu$  to  $17\mu$ , or exceptionally  $20\mu$ . This form obviously corresponds to the types "a" and "b" mentioned above. Finally, forma *moniliformis* Høeg represents colonies in which a prevailing direction of the tubes may sometimes be traced. The tubes are often parallel to each other and appear in cross-section as straight or curved rows of circles. The tube-width is  $23\mu$  to  $30\mu$ . This is the form "d" described here, but the Norwegian form has tubes about twice as wide as the Canadian form. It will also be seen that in longitudinal sections along or near the spiral axis of *G. spiralis*, two parallel, or converging, rows of circles will represent the cross-sections of the tube-

walls, in contrast to the one row exhibited by sections of forma *moniliformis*.

*Stratigraphical considerations.* The Shumardia Limestone containing *G. spiralis* occurs in the uppermost zone, or *Glyptograptus dentatus* zone (D), of the graptolitic succession established by Raymond in the Lévis Shales (11). Raymond's interpretation of the succession has been somewhat modified by Clark (1), but this author accepts Raymond's zone "D" and also its two sub-zones, D<sub>1</sub> below, corresponding to the Shumardia Limestone, and D<sub>2</sub> above, consisting of shales with *Glyptograptus dentatus* and other graptolites. Although it appears to be the common practice for most American geologists to place the *Gl. dentatus* zone in the Beekmantown, since most of its characteristic graptolite types appear in the Arenig Llanvirn of Britain (4), Ruedemann definitely correlated this zone with the Chazy limestones of the Champlain region (13). Force is added to Ruedemann's correlation by the recent statement by Elles (3) that the fossil to which the name *Diplograptus* (*Glyptograptus*) *dentatus* Brongniart is given in America is actually *Glyptograptus teretiusculus* (Hisinger), which corresponds to a late *Gl. dentatus*, and is the zone-fossil of the Llandeilo in Britain. The discovery in the Shumardia Limestone of *Girvanella*, a fossil common in the Chazy limestones of Vermont, New York, Tennessee and the Mingan Islands (15), would appear, therefore, to add further evidence in favour of the correlation of zone D of the Lévis Shales (and of the Deepkill section, New York) with the Lower Chazy limestones\*. It is also significant in this connection that the earliest appearance of abundant *Girvanella* in the Ordovician rocks of Britain occurs in the Stinchar Limestone (8), which Jones has represented as the reproduction in south Scotland of the Lenoir formation (Lower Chazy) of Tennessee, which has likewise yielded *Girvanella* (6, 15).

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\* The obvious alternative is to regard the Shumardia Limestone as Upper Beekmantown and *G. spiralis* as the forerunner of *G. ocellata*, which reaches its acme as fully developed nodular growths in the Lower Chazy limestones.

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#### EXPLANATION OF PLATE I.

*Girvanella problematica* var. *spiralis*, var. nov.

Shumardia Limestone, Lévis Series, Lévis, Quebec.

- Fig. 1. Form "d," p. 51.  $\times$  about 70. Slide no. V. 26830. (Cf. *G. problematica* forma *moniliformis* Høeg.)
- Fig. 2. Form "b," p. 51.  $\times$  about 70. Slide no. V. 26830. (Cf. *G. problematica* forma *lumbricalis* Høeg.)
- Fig. 3. Form "b," p. 51.  $\times$  about 70. Slide no. V. 26830. Transitional to form "d."
- Fig. 4. Form "b," p. 51.  $\times$  about 50. Slide no. V. 26830. Transitional between forms "a" and "c."
- Fig. 5. Form "c," p. 51.  $\times$  about 70. Slide no. V. 26830. (Cf. *G. problematica* forma *typica* Høeg.)
- Fig. 6. Form "e," with form "c" at extremities, p. 51.  $\times$  about 70. Slide no. V. 26830. (Cf. *G. ocellata* (Seely).)
- Fig. 7. Form "e," holotype of *G. problematica* var. *spiralis*.  $\times$  80. Slide no. V. 26831.
- Fig. 8. Form "e," p. 51.  $\times$  about 75. Slide no. V. 26831. (Cf. *G. problematica* forma *moniliformis* Høeg.)

The microslides containing the fossils figured on Plate I. have been deposited in the Department of Geology, British Museum (Natural History), and the register numbers refer to the collection in that Department.

VI.—*Descriptions and Records of Bees.*—CLXXXIV.

By T. D. A. COCKERELL, University of Colorado.

*Halictus acanthostomus*, sp. n.

♀.—Length about 6 mm., anterior wing 4.5

Black, rather slender; head and thorax with white hair, forming a dense conspicuous band along hind margin of mesonotum, and slender lines at sides, dense white tomentum also covering postscutellum. Head rather narrow, sides of face with white hair; labrum with a central pit; process of labrum with a long central spine, on each side of which are golden hairs; clypeus and supra-clypeal area shining; front dull, vertex shining; flagellum red beneath; mesonotum polished on disc; scutellum polished; area of metathorax very large, dull, with a thickened, somewhat shining margin; the microscope shows the area to be roughened with a very fine obscure irregular reticulation; tegulae pale testaceous. Wings milky hyaline, stigma and nervures very pale, but border of marginal cell darker; second cubital cell higher than broad, receiving recurrent nervure at apical corner; outer side of third cubital very weak, strongly bulging outward; front tibiae and tarsi pale red; middle and hind tibiae pale at ends; hind spur of the type of *H. subvillatus* Ckll., and *H. jessicus* Ckll. Abdomen with the first tergite shining, and a patch of pale tomentum at each side; second tergite with a rather broad uniform band of pale tomentum at base; the following tergites practically covered with pale tomentum, except that the third has a black (bare) transverse band. In a second specimen the front tibiae and tarsi are very pale yellow, the tibiae dark behind.

Orange Free State; North Bank Halt. Norval's Pont, April 14, 1934 (*J. Ogilvie*).

Related to *H. jessicus* Ckll., but that has no basal band on second tergite, and is a smaller species.

*Halictus sublautus*, sp. n.

♀.—Length 5 mm., anterior wing about 4.

Black, the first tergite with a linear stramineous apical tegumentary band, and the second with a rather broad one, and the margins of the following two somewhat pallid. Head approximately circular seen from in front;

clypeus short, shining; supraclypeal area shining; front weakly shining; flagellum red beneath; mesonotum dull, scutellum a little shining, but not polished; no white hair along hind margin of mesonotum, and postscutellum not conspicuously tomentose; area of metathorax large, dull, with a shining, much thickened hind margin; the microscope shows the area to have a minutely rugulose or tessellate surface, with a tendency to cross striæ, and on the basal half very weak, irregular plicæ; tegulæ pale testaceous; stigma light reddish brown, nervures pale. The wings clear hyaline; second cubital cell receiving recurrent nervure at apical corner; hind spur with three spines, the first two long (style of *H. nigri-mentis* Ckll.). Abdomen rather broad, moderately shining, with no hair-bands or spots, but the apical part is thinly hairy.

Cape Province: Van Rhyn's Pass, Nov. 1931 (*Alice Mackie*). Two specimens.

Related to *H. umtaliellus* Ckll., but much larger and more robust, with duller mesonotum. *H. plicatinus* Ckll. is easily separated by the shining area of metathorax.

*Halictus (Oxyhalictus) palapyeensis*, sp. n.

♂.—Similar in nearly all respects to *H. mutopiensis* Ckll., but the area of metathorax is much larger, with a dull surface and no shining margin; the microscope shows no regular radiating plicæ, but numerous irregular rugæ; the tibiæ and basitarsi are all black, but the small joints of tarsi are pale red; clypeus short, shining, with a median groove and no light mark; apical plate rounded, not very large, red. A noticeable feature is the abundant erect white hair on thorax above. The marginal cell is narrowly truncate at end. The hind legs are normal for the male, without tibial scopa. This is easily known from *H. trimeni* Ckll. by the light red tegulæ.

Bechuanaland: Palapye, March 4, 1934 (*J. Ogilvie*), type-locality. Also one (without head) from S. Rhodesia; Matopo Hills, May 1, 1932 (*C. P. Harvey*).

I had taken this for the female of *M. matopiensis*, until I noticed that the specimens were certainly males. The Matopo Hills specimen is more robust than the type. The antennæ of the type are broken, but enough is left to show that the flagellum is dull red beneath, and the joints



on the basal half are about as long as broad. In the subgenus *Oxyhalictus* there is a tendency for the secondary sexual characters to be transposed, producing what may be called pseudogynandromorphs.

*Halictus phenacorrhinus*, sp. n.

♂.—Length about 7 mm., anterior wing 5.

Black, including legs, except that tarsi are pale reddish apically; hair of head and thorax dull white; head oval, the clypeus greatly produced, convex, shining, with irregular punctures; supraclypeal area dull as seen from in front, but seen from below shining; mandibles black; front dull, with a shining line along orbits; vertex moderately shining; antennæ very long (longer than in *H. trimeni* Ckll.), the flagellum dusky beneath, with the sutures darkened; mesonotum finely punctured, moderately shining; scutellum highly polished on disc; postscutellum large, with pale hair at base; area of metathorax large, glistening, with very distinct wavy plicæ; tegulæ shining black. Wings greyish hyaline, stigma reddish brown; nervures brown; second cubital cell very large and square; first recurrent nervure joining base of third cubital cell; third cubital cell not produced apically. Abdomen parallel-sided, moderately shining, with entire but inconspicuous hair-bands at bases of second and third tergites; third tergite with the depressed part very large and the margin very narrowly stramineous; fourth and fifth tergites with weak subapical hair-bands; apical plate dark; no subapical spines.

S. Rhodesia; Matopo Hills, April 17–30, 1932 (*J. Ogilvie*).

In several respects this resembles *H. matopiensis* Ckll., but it is easily separated by the entirely black clypeus and the black tegulæ. Compared with *H. shanganiensis* Ckll., it is easily distinguished by the darker flagellum and oval head, but it is evidently allied. Male *H. shanganiensis* (a variety with red tegulæ) was also taken in the Matopo Hills, May 1, 1932 (*C. P. Harvey*).

*Halictus pulchrinitens*, sp. n.

♀.—Length nearly 7 mm., anterior wing about 5.

Black, with the clypeus, supraclypeal area, sides of face, mesonotum and scutellum very highly polished; hair of head and thorax clear white, dense on cheeks and underside of thorax; hind margins of tergites obscure

brown, hind tibiæ and tarsi dark brown. Head broad; clypeus convex, very prominent, with a median groove; front dull, except broad bands next to orbits, which are shining and strongly punctured; flagellum obscurely brownish beneath; scutellum elevated, but not gibbous; hair of postscutellum not dense; area of metathorax large, with delicate plicæ more or less joined by cross-ridges, forming a network; hind margin of area with a pair of large callosities; tegulæ very dark brown. Wings hyaline, with very pale yellowish stigma and pale nervures; second cubital cell narrowed above, receiving recurrent nervure at apical corner; third cubital cell very large, but not produced apically; both spurs of hind legs finely ciliate, not dentate (style of *H. serriferus* Ckll.). Abdomen broad, shining, with thin pale hair at sides, but no hair-bands or spots; hair of venter very short.

Cape Province: Graaff-Reinet. Oct. 24-27, 1931 (*J. Ogilvie*). Also taken at Uitenhage, Oct. 30, 1931 (*J. Ogilvie*). Four specimens.

Allied to *H. pastinus* Ckll., but clypeus narrower and elevated, and metathorax different. It differs from *H. nitidibasis* Ckll. by the thickened margin of metathoracic area, and the peculiar elevated highly polished clypeus.

At Graaff-Reinet I collected a specimen of *H. pastinimimus* Ckll., a variation with the mandibles not perceptibly red. This looks like a small *H. pulchritens*, but has a hind spur resembling that of *H. nitidibasis* Ckll. and *H. graaffi* Ckll., while the area of metathorax is minutely densely punctured all over, with a few widely spaced short, very weak plicæ at extreme base. Thus the two species are apparently little related.

### *Halictus pallidipennis* Smith.

A male which I refer to this species was taken at Ceres, Feb. 1932 (*A. Mackie*). It will be known by the very clear wings, large pale stigma; face with dull white hair; clypeal margin prominent, with a pale yellowish band which has a pointed extension upward in middle; scape with a pale stripe; flagellum pale clay-colour beneath; mesonotum dullish; tegulæ very pale, dark at base;

tibiæ and tarsi pale yellow, the middle and hind tibiæ with a large black mark in front ; anterior femora broadly yellow at apex ; hind margin of tergites pallid. Female *H. pallidipennis* is known to occur at Ceres.

The following records of *Halictus* are new :—

*H. rufomarginatus* Smith. Rapenburg, Cape Flats, Oct. 1–14, 1920 (*R. E. Turner*) ; Cape Town, Milnerton, Dec. 14–28, 1925 (*R. E. Turner*).

*H. matoporum* Ckll. Harrismith, O. F. S., March 1–20, 1927 (*R. E. Turner*).

*H. deceptus* Smith. Stellenbosch, Aug. 21, 1926 (*R. J. Nel*).

*H. perileucus* Ckll. & Ireland. Graaff-Reinet, Oct. 1931, one male (*Cockerell*).

*H. nigrimentis* Ckll., variety *a*. Orange Free State : North Bank Halt, Norval's Pont, April 16, 1934 (*J. Ogilvie*). Differs from the type in the pattern of the abdomen, but very likely only an individual variation. First two tergites clear red, the first with a black band at base, and a black spot on each side before the depression ; second tergite with a dark mark on each side, third red at base ; third and fourth tergites with very broad pallid margins.

#### *Hesperapis callura* (Cockerell).

Mr. R. E. Turner collected many of each sex at Aus, and gave all the same number (27). The males are the race of *H. nivea* (Ckll.) reported in Bees, cxlviii. p. 446. The original *H. callura* and *H. nivea* both came from Graaff-Reinet, and there is now no doubt that they are the sexes of one species. At Prince Albert Road, Turner collected both sexes of *H. turneri* Ckll., and the females have the abdomen variably (sometimes wholly) red.

#### *Colletes noskiewiczzi*, nom. nov.

*Colletes albescens* Noskiewicz, Die Palearktischen Colletes-Arten, 1936, p. 330. Spain. At my request the Polish Embassy in Washington tried to find out what had become of Noskiewicz since the invasion of his country, but nothing could be learned concerning him.

VII.—*On the Occurrence of Sphenotrochus (S. davisii, sp. n.) in the English Auversian Deposits.* By H. DIGHTON THOMAS, M.A., Ph.D., F.G.S., Department of Geology, British Museum (Natural History).

REPRESENTATIVES of the genus *Sphenotrochus* Edwards & Haime have hitherto not been recorded from the Palæogene rocks of Great Britain, although a few species have been obtained from those of the Paris Basin (Edwards & Haime, 1848, pp. 241-246). In England the genus has been recorded fossil only from deposits not earlier than the Pliocene (Edwards & Haime, 1850; Tomes, 1888), but recently, by careful washing and sorting of the clay, Mr. A. G. Davis discovered five specimens of a new species of *Sphenotrochus* in one of the beds of the Upper Auversian of Sussex.

Family **Turbinolidae** Edwards & Haime.

Genus SPHENOTROCHUS Edwards & Haime, 1848, p. 240.

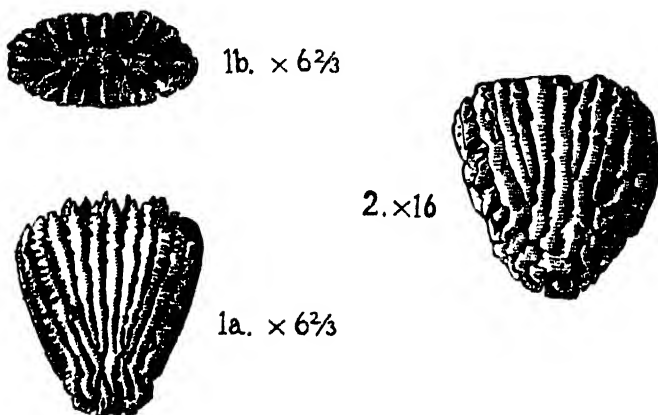
Genolectotype (*vide* Edwards & Haime, 1850, p. xvi.): *Turbinolia crispa* Lamarek (1816, p. 231).

*Sphenotrochus davisii*, sp. n. (Figs. 1a, 1b, 2.)

*Description*.—Corallum small, cuneate, compressed, of oval cross-section, attaining a height of 4.5 mm. with the calicular axes 3.75 mm.  $\times$  2.3 mm. Calicular margin rising slowly from a minimum at the ends of the longer transverse axis. Base not very broad, bluntly rounded. Metal\* edges almost straight, diverging at an angle of about 35°. Columella lamellar, thin. Septa exsert, those in the middle of the flattened faces projecting much more than those at the sides. Septa 24 in number, their upper edges entire and steeply descending axially—three cycles present, those of the first two reaching to the columella, and those of the third extending only half-way. All taper slightly axially and are covered with small spinose granules. Costæ flattened, equal in number to the septa—those in the middle of the flattened faces crispate, but only feebly so in the lowermost two-thirds, though the extent of the crispation increases outwards from the

\* Lat., *mēta*, -ae = "turning point of a race-course." The term is introduced to apply to the area and accompanying structures in the neighbourhood of the ends of the longer axes of the elliptical cross-section of the corallum. The "e" in "metal" is long.

middle; those in the metal area (three in each) broader than these, fairly strongly crispate throughout their length. Costæ not always symmetrically developed, and those in the middle of the flattened faces at times twisted



*Sphenotrochus davisii*, sp. n.

Fig. 1 a.—Side-view of holotype, B.M., R. 28200.

Fig. 1 b.—Calicular view of holotype.

Fig. 2. —Side-view of immature specimen, B.M., R. 28201.

and broken proximally. All the costæ reach to, or nearly to, the base, except for the pair on either side of the median costa of each flattened face—these are intercalated at one-quarter of the height of the coral from the base, and are slightly unequal in size, although they show variation in their relative lengths.

*Occurrence.*—Auversian, band of Brown Clay (three inches thick) at the top of Bed 17 of Osmund Fisher (1862, p. 74), Upper Bracklesham Beds, foreshore opposite Medmerry Farm, Selsey, Sussex.

*Holotype specimen* (figs. 1 a, 1 b): Brit. Mus., R. 28200.

*Paratype specimens*: Brit. Mus., R. 28201-4.

*Remarks.*—Among the five specimens on which the species is founded is one (R. 28201) which is immature (fig. 2). It is only 1.6 mm. high, with calicular axes measuring 1.6 mm.  $\times$  1.0 mm. Even so, all the 24 septa are present in the calice, and the full number of costæ is also developed, the newest being introduced at a point situated at half the height of the corallum. This young specimen shows differences from the adult in its wider

angle (about  $45^{\circ}$ ) between the metal edges, and its consequently greater equality between the height of the corallum and the length of the longer transverse calicular axis, in its less crispate costæ, in the less irregular nature of the costæ in the proximal area, and in the septa being thin and not exsert. They appear to become slightly twisted at the columella.

In its general characters *S. davisi* approaches the Lutetian *S. crispus* Lamarek (1816, p. 231; Edwards, 1849, pl. lxxxii. fig. 4; Ryder, 1927), but is distinguished from that species by its smaller size, smaller angle between the metal edges, and less crispate, but proximally broken, costæ. *S. mixtus* DeFrance (1845, p. 151, pl. xliii. figs. 3a, 3b) from the same horizon, on the other hand approaches *S. davisi* in general shape, although the former is longer and narrower, while its costæ are more regular and are scarcely crispate. Edwards & Haime (1848, p. 243, pl. vii. fig. 3) also described *S. pulchellus* from the Calcaire Grossier of Grignon. Like those of *S. davisi* its costæ are broken inferiorly, but distally they differ markedly in the degree of crispation--the metal edges, too, are concave in *S. pulchellus*.

It is interesting to note that *S. davisi* agrees with the other Eocene species of Europe in possessing only 24 septa and costæ, whereas the American Eocene species may have another septal cycle introduced, increasing the number to 40 (Vaughan, 1900, pp. 80-86).

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VIII.—*Descriptions of a few Ants from the Philippine Islands, and a Male of Polyrhachis bihamata Drury from India.* By HORACE DONISTHORPE, F.Z.S., F.R.E.S., &c., Department of Entomology, British Museum (Natural History).

Subfamily *PONERINÆ* Lepeletier.

*Harpegnathos medio-niger*, sp. n.

♂. Shining, head, pronotum, scutellum, post-petiole and gaster yellowish brown; eyes, rest of thorax and petiole black; mandibles yellow, antennæ, palpi and legs pale yellow. Whole body clothed with longer and shorter pale yellow outstanding hairs.

*Head* smooth and shining, transverse rounded from behind eyes to posterior border, which is slightly and widely excised and sharply and narrowly margined; *clypeus* large, transverse, slightly convex, somewhat narrowed posteriorly, anterior border almost straight; *frontal area* large, triangular; *frontal carinæ* short; *insertions* of antennæ entirely uncovered, situated behind the pointed base of frontal area, space between with a short narrow raised longitudinal line, or carina; *eyes* very large, oblong oval, prominent; *ocelli* large, situated on top of head; *antennæ* long, 13-jointed, *scape* short, *funiculus* with first joint shorter than scape, slightly longer than broad, rest of joints pubescent, much longer than broad, about equal in length and breadth, last joint a little longer than the preceding, pointed at apex; *mandibles* rudimentary, sharply pointed; *maxillary palpi* long, 5-jointed, 1st joint short, the rest elongate, 3rd joint longer than 2nd and 4th. *Thorax* elongate, narrowed in front and behind, broadest at insertion of the wings; *pronotum* transverse, narrowed to a neck anteriorly, posterior border widely and deeply excised, narrowly margined, disc smooth and shining, with a short transverse furrow enclosing a raised transverse central portion just before margin, sides sparsely punctate and transversely striate; *mesonotum* with two shallow narrow longitudinal impressed lines which are close together at anterior border, meeting before base of mayrian furrows and continuing more or less distinctly to basal border, a few shallow scattered oblong punctures occur on each side of these lines; *mayrian furrows* rather

broad, distinct, and longitudinally striate; rest of mesothorax behind mayrian furrows, and between parapasidal furrows, with scattered large shallow oblong punctures and some impressed lines, a deep longitudinal pointed furrow occurs outside parapasidal furrow; *episternite* and *epimera* of mesothorax and *episternite* of metathorax transversely striate, *furrow* between episternite and epimera of mesothorax deep, and widely longitudinally striate; *suture* between præscutellum and scutellum not defined; *præscutellum* consisting of a rather deep transverse hollow in centre, which is furnished with a number of widely separated raised longitudinal ridges; *scutellum* convex, prominent, smooth in centre, with shallow oblong punctures on anterior portion, and with rather deep hollows which are longitudinally striate at sides; *metanotum* transverse, narrow, smooth, convex, and prominent in centre, somewhat hollowed out and finely longitudinally striate at sides; *epinotum* longer than broad, narrowed to base, *dorsal surface* covered with a network of strongly-raised ridges, *declivity* flat hexagonal in shape, bordered by raised ridges, with a longitudinal raised ridge in centre from which raised transverse ridges branch. *Petiole* longer than broad with a high node rounded above, narrowed anteriorly with a small tubercle on each side before base and a very small blunt tooth beneath, upper surface smooth, sides covered with a network of closely-raised ridges, posteriorly somewhat triangularly excavated, the upper portion smooth, the lower with longitudinally-raised ridges; *post-petiole* smooth, pyriform in shape, considerably longer and broader than petiole, constriction between post-petiole and second segment of gaster very marked; *gaster* smooth, long oval, broadest before base of second segment; *pygidium* terminating in a fairly long curved sharply-pointed spine; *subgenital lamina* fairly long, bluntly pointed at apex; *cerci* present. *Wings* iridescent, *veins* and *pterostigma* yellow, one *discoidal cell* and two long *cubital cells* present, *radial cell* long, closed, appendiculate at apex. *Legs* long, slender, two *spurs* to posterior pairs of *tibiæ*, *claws* bidentate.

*Long.* 10.5 mm.

Described from a male taken by C. F. Baker at Mt. Banohao, Philippines, 1924—486.

Type in Brit. Mus. Coll.

*Ann. & Mag. N. Hist.* Ser. 11. Vol. ix.



It is very like *H. pallipes* Smith, from Java, in appearance; but besides the difference in the colour, the sculpturation is considerably stronger. The hexagonal declivity of the epinotum in *pallipes* is without the raised ridges, and the petiole is armed with a strong curved tooth beneath.

Subfamily MYRMICINÆ Lepeletier.

*Vollenhovia soleaferrea*, sp. n.

♀. Dark reddish-brown mandibles, antennæ, anterior part of head narrowly, and legs red; masticatory border of mandibles and teeth black. Clothed with semi-decumbent longer and shorter yellow hairs.

*Head* subquadrate and subparallel, posterior angles rounded, posterior border slightly emarginate, sculpture consisting of more or less longitudinal raised ridges which form a network and enclose shallow oblong punctures; *mandibles* powerful, shining, punctate, masticatory border armed with five strong teeth; *clypeus* smooth and shining, strongly bicarinate, anterior border straight; *frontal area* small, triangular, deep, shining; *frontal furrow* broad and shallow, extending to median ocellus; *frontal carinæ* short, finely longitudinally striate inside of outer edges; *eyes* fairly large, oval, convex, situated in about centre of sides of head; *ocelli* small; *antennæ* 12-jointed, *club* 3-jointed; *scape* barely reaching posterior border of median ocellus, *funiculi* gradually thickened towards apex, joints 2-6 strongly transverse, 7-8 less so, last joint pointed, about equal in length to the two preceding joints taken together. *Thorax* longer than broad, narrowed to base, broadest at insertion of anterior wings; *pronotum* transverse, humeral angles obtuse but prominent, covered with rather large shallow punctures except at anterior border, which is narrowly smooth; *pro-mesonotal suture* well marked, deep; *mesonotum* longer than broad, only slightly convex, with a narrow space extending from apex to base, pointed behind, smooth, rest covered with a series of shallow punctures arranged in longitudinal rows; *præscutellum* only visible at sides, punctured; *suture* between mesonotum and scutellum very narrow but distinct; *scutellum* transverse, rounded above and below, only slightly convex, smooth in centre, with a few fairly large shallow punctures arranged in rows at sides; *metanotum* transverse, narrow, smooth in centre; *epinotum* with dorsal surface much

shorter than declivity, smooth and shining, with a few scattered shallow punctures, declivity in the shape of a horse-shoe, very slightly concave, smooth and shining; *node* of *petiole* rather high, thick, rounded above, anterior and posterior surfaces concave, smooth and shining, fairly striate and punctate at sides, armed beneath with a thin projecting, bluntly-rounded ridge or tooth; *post-petiole* broader than node of *petiole*, anterior border and dorsal surface round, sides straight, posterior border straight, narrowly margined, faintly transversely striate behind and with a few scattered shallow punctures on disc, armed beneath with a blunt tooth projecting downwards; *gaster* long oval, broadest behind middle, with a shallow narrow shining furrow with short raised longitudinal ridges at junction with *post-petiole*, first segment long, with a few small scattered punctures more numerous anteriorly; the other segments very finely coriaceous. *Wings* light brown *pterostigma* and *veins* darker, *anterior wing* with one *discoidal cell*, one long *cubital cell* and *radial cell* open, clothed with fine brown decumbent hairs, forming a fringe round the margins.

*Long.* 7.3 mm.

Type in Brit. Mus. Coll.

Described from a single winged female; Philippine Islands, Luzon, Mt. Makiling (*C. F. Baker*), Brit. Mus., 1924—486.

This species comes near to *V. oblonga* Smith. from Borchian—its subspecies, *laevithorax* Emery, from Borneo; from the former it differs in having a much finer sculpture, the shoulders considerably more prominent, etc., and from the latter in being larger, more robust, less strongly sculptured, with more prominent shoulders, etc.

Only two other species and one subspecies of *Vollenhovia* have been found in the Philippines, and *soleaferrea* disagrees entirely with the descriptions of any of them.

*Rhopalothrix (Rhopalothrix) subdentatus*, sp. n.

♀. Reddish brown, antennæ and legs lighter, somewhat shining. The insect has been rather rubbed, but there are a few unevenly scattered semi-decumbent white clavate hairs on body.

*Head* triangular, considerably broader behind eyes, forming lobes with truncate posterior borders, posterior border deeply emarginate; some slightly-raised longi-

tudinal ridges extend from base of clypeus, and towards posterior part of head form a network enclosing round shallow punctures; *mandibles* long, triangular, curved, masticatory border armed with 8 teeth, the apical one long and pointed, two small sharp teeth are situated about the middle beneath the masticatory row; *clypeus* large, triangular, slightly convex, anterior border straight, posterior border pointed and extending between the frontal carinæ, rather finely and shallowly punctured; *frontal carinæ* deeply excised in middle of outer sides, forming a lobe behind covering the profound and deep *scrobes*; *antennæ* 7-jointed, rather short, *scape* triangular, flat above, broadly dilated at base, nearly as long as *funiculus*, anterior border fringed with a row of white outstanding clavate hairs; *funiculus*: first joint about as long as broad, broader and longer than second joint, last joint long and pointed, longer than the three preceding taken together; *eyes* convex, oval, moderate; *ocelli* small. *Thorax*, sculpture finely rugose, robust, narrowest at base; *pronotum* large, convex, transverse, narrowed anteriorly, sides rounded, posterior border very emarginate; *pro-mesonotal suture* very distinct; *mesonotum* large, narrowed anteriorly, broadest just before base, not very convex, a smooth, longitudinal, rather broad, shallow furrow extends from centre of anterior border, not reaching the middle of mesonotum and diverging in a short V; *præscutellum* very narrow and transverse, suture between it and scutellum marked with a row of short longitudinal narrow raised ridges, spaces between smooth; *scutellum* convex, outstanding, narrowed and projecting posteriorly; *epinotum* with very short dorsal surface, declivity considerably excavated, armed on each side with a sharp-edged pointed projection. *Petiole* with a small rounded not very high node posteriorly, furnished, beneath with a narrow ridge pointed anteriorly; *post-petiole* transverse, convex, rounded at sides and anteriorly posterior border slightly projecting in middle, much broader than petiole; *suture* between post-petiole and gaster very distinct and deep; *gaster* longer than broad, long oval, sculpture finely but distinctly coriaceous, first segment very long. *Legs* short. *Wings* dusky brown, *pterostigma* and *veins* darker brown, covered with fine decumbent brown hairs which extend as a fringe beyond side margins and part of posterior margin, one

long cubital cell and long closed radial cell present. pterostigma narrow and ill-defined.

Long. 5 mm.

Type in Brit. Mus. Coll.

Described from a single winged female. Philippines, Luzon. Baguio (C. F. Baker), Brit. Mus., 1924—486.

This species has not been described before, nor is it a female of any known worker. Only two species have been recorded from the Philippines—*R. angulinoides* Stitz, ♀, and *R. manni* Menozzi, ♀, the descriptions of the head of neither of which agrees with that of our female. Some six species have been found in New Guinea, including *R. kokodensis*, described by us in 1936.

# Subfamily DOLICHODERINÆ Forel.

## *Tapinoma philippinensis*, sp. n.

♀. Black, tip of antennæ, what appears to be the lateral prolongations of the clypeus, extending into the clypeal fovæ, part of mandibles, base of first joint and last four joints of tarsi, and spurs red. Clothed with fine yellow pubescence and short outstanding yellow hairs, which are more abundant on the gaster. Sculpture very finely, minutely and closely coriaceous.

Head about as long as broad, narrowed in front, broadest just behind eyes, posterior angles rounded, posterior border excised in middle; mandibles powerful, tips crossed, masticatory border armed with 7 teeth; clypeus transverse, triangular, only slightly convex, anterior border almost straight; clypeal foræ round, deep; frontal area and furrow very indistinct; eyes large, round, not very convex, situated at about centre of sides of head; ocelli small; antennæ 12-jointed, moderate, scape gradually broader towards apex, with transverse joints, last joint pointed, a little longer than the two preceding taken together. Thorax narrowed posteriorly; pronotum transverse, narrow; mesonotum convex, about as broad as long; scutellum convex, triangular; epinotum with very narrow dorsal surface, the declivity being considerably longer, rather abrupt, rounded, convex. Petiole with scale and gaster typically *Tapinoma*. Wings brownish, pterostigma and veins darker brown, small discoidal cell, one long cubital cell and long closed radial cell present.

Long. 5.3 mm.

Type in Brit. Mus. Coll.

Described from a winged female specimen. Philippine Islands, Luzon, Mt. Makiling (*C. F. Baker*), Brit. Mus., 1924—486.

This species is superficially like a large female *nigerrimum*, but the antennæ are shorter and the funiculi considerably stouter, the mesonotum is shorter and more convex, the scutellum is smaller and more convex, and the epinotum with the dorsal surface narrower and the declivity convex; the latter being flat in *nigerrimum*. Moreover, the anterior border of the clypeus is not deeply excised as in that species.

Subfamily *FORMICINÆ* Lepelletier.

(*Ecophylla smaragdina* F., subsp. *subnitida* Emery, Ann. Soc. Ent. France, lx. p. 565 (1891), ♀.

♀. Typical *Ecophylla* female; yellowish testaceous; mandibles, scapes, base of first five joints of funiculus, two rather broad converging lines of mesonotum, and sides and epinotum brownish; teeth, and anterior border of scutellum narrowly, black.

♀ type in Brit. Mus. Coll.

Described from a dealated female, Philippine Islands (*E. M. Ledyard*), Brit. Mus., 1925—491.

I take this insect to be the female of Emery's subspecies *subnitida*, the workers of which have been recorded from the Philippines. The yellowish testaceous ground-colour, the texture, sculpture, etc., being the same.

Emery described it from New Guinea, and it has also been taken in the Moluccas and Solomon Islands.

*Polyrhachis bihamata* Drury.

♂. The whole body of a testaceous colour, the head, thorax and scapes being somewhat darker; the gaster, petiole, legs and funiculi somewhat lighter, yellowish. Body furnished with outstanding yellow hairs, more abundant towards apex of gaster. Sculpture of a very fine, close, coriaceous nature. Head posteriorly and thorax rather dull, clypeus, petiole and gaster shining.

Head longer than broad, narrowed behind eyes, posterior angles blunt, posterior border almost straight; cheeks parallel; mandibles rather long, triangular, pointed at apex, masticatory border unarmed; clypeus large,

broad, triangular, anterior border rounded, carinate in centre; *frontal area* indistinct; *frontal furrow* very narrow and shallow, extending to median ocellus; *eyes* very large and prominent, situated towards back of sides of head; *ocelli* large, prominent, situated on top of back of head; *antennæ* 13-jointed, long, slender, filiform. *Thorax* longer than broad, narrowed anteriorly and posteriorly, broadest just before insertion of anterior wings; *pronotum* transverse, narrow, anterior border narrowly, but sharply, margined, posterior border encircling the mesonotum; *mesonotum* long, convex in front, rather flat on dorsal surface, with two narrow, very shallow lines close together, which converge and meet on the dorsal surface and continue as a very narrow, shallow furrow, extending to posterior border of mesonotum; *mayrian furrows* wanting; *parapsidal furrows* very narrow and shallow; *præscutellum* transverse, very narrow in centre; *scutellum* convex and prominent; *metanotum* transverse and narrow; *epinotum* longer than broad, evenly rounded, without an angle between dorsal surface and declivity; *node of petiole* low, rounded, concave on anterior surface and, except in centre of upper surface, posterior surface rounded; *gaster* long, oval, narrowed in front and behind, broadest at base of second segment; *cerci* present; *genitalia* projecting, *stipites* long and pointed. *Legs* long, slender. *Wings* pale yellow, *veins* and *pterostigma* brighter yellow, type *Formica*; *radial cell* long, longer than cubital cell, closed.

*Long.* 10.5 mm.

♂ type in Brit. Mus. Coll.

Described from a single male labelled "Dukhun, ex coll. Sykes."

As far as I am aware, no male belonging to the subgenus *Polyrhachis* of *Polyrhachis* has been described. Emery, in the 'Genera Insectorum,' clxxxiii. p. 182 (1925), gives under *P. (P.) bihamata* Drury "Forel in Grandidier, Hist. Nat. Madagascar, vol. xx. 2, p. 78 (1861), ♀♀♂," but on looking the record up one finds that Forel writes "♂ inconnu"! (Of course, as Forel mentions, *P. bihamata* has never been found in Africa, nor in Madagascar.)

*Nylanderia iridescens*, sp. n.

♀. Brown, tarsi and palpi yellowish, whole body very finely and delicately shagreened, and with a strong

violet metallic reflection; clothed with sparse scattered outstanding hairs or bristles (*machæritæ*), more numerous on gaster, no outstanding hairs on legs or antennæ.

*Head* longer than broad, slightly narrowed in front and behind, broadest about middle, posterior angles bluntly rounded, posterior border straight; *mandibles* long, narrow, masticatory border armed with three small sharp teeth, the apical one being considerably the longest; *clypeus* transverse, convex, anterior border broadly rounded; *frontal area* not defined; *frontal furrow* very faint, short; *eyes* large oval, only slightly convex, situated above the centre of sides of head; *antennæ* long, slender, *scapes* extending about a quarter of their length beyond posterior border of head, *funiculus* with very small short second joint, about as broad as long, rest of joints longer than broad, 3 to 6 subequal, 7 to 10 very slightly longer, last joint about as long as the two preceding taken together. *Thorax* longer than broad, constricted in middle, broadest across the pronotum, in profile the mesonotum is higher than pronotum and epinotum; *pronotum* transverse, anterior angles rounded; *mesonotum* convex, slightly longer than broad; *metanotal spiracales* small, not prominent; *epinotum* with narrow *dorsal surface* rounded into long flat declivity; *scale of petiole* rather thick, inclined forwards, anterior surface concave, posterior surface convex, upper margin narrow, rounded; *gaster* short, oblong oval, broadest before middle, tip sharply pointed, first segment with a concavity for the reception of the scale.

*Long.* 2 mm.

Type in Brit Mus. Coll.

Described from six workers taken under stone, Philippine Is., Luzon, "Convent" Valley, Baguio, Dr. A. Moore, 14. ii. 20. Brit. Mus., 1922—101.

This species belongs to Emery's group with two pairs of macrochetes on the pronotum, one pair on the mesonotum, and one pair on the epinotum, which includes *albipes* Emery, *aseta* Forel, *caledonica* Forel, *foreli* Emery, *lecanopterides* Donisthorpe, *minutula* Forel, *opaca* Emery, and *pusillima* Emery. No species of *Nylanderia* appears to have been recorded from the Philippines heretofore.



H. P. L. photo.

*Girvanella problematica* var. *spiralis*.





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IX.—*Notes on Recent and Fossil Equines.*—1. *Anatomical Features of certain Limb-bones.* By A. TINDELL HOPWOOD, D.Sc., F.L.S., Department of Geology, British Museum (Natural History).

THE discovery in the United States of the wonderful unbroken evolutionary sequence of fossil horses of all types, from the most simple to the most advanced, has tended to divert the interest of many palæontologists from the equine remains of the Old World to those of the New. This is regrettable for two reasons. First, very few details of the skeleton of the American fossils have been published; most authors have dealt either with the structure of the teeth, or with the proportions of the limbs, or with the gross outlines of the evolution of the monodactyl foot; secondly, the American forms are but poorly represented in European museums, so that, in the end, one is thrown back upon the European members of the group for purposes of study. This was my own position when I began work on the fossil horses of the East African Pleistocene, and the following pages are an expansion of notes made at that time.

The problem was to separate isolated limb-bones of one-toed horses, actually large Zebras, from those of a

member of the *Hipparion* group. Not every bone is represented in the collections from East Africa, and comparisons were naturally restricted to those which are. Even so, the results are not without interest, and since it will inevitably be many years before the final account of the mammalian faunas of Olduvai and other East African localities is published, there seemed to be no good reason why these notes should not be published independently. They contain descriptions of various anatomical features observed on some of the more important specimens in the British Museum.

The Recent skeletons are all preserved in the Zoological Department. The list, together with the Register number and page reference to Lydekker's 'Catalogue of Ungulate Mammals,' vol. v., follows :—

- (i.) *Equus caballus przewalskii* Poliakoff, ♀, 2.9.25.1, *op. cit.*, p. 7.
  - (ii.) *E. c. przewalskii* Pol., ♂, 7.5.15.2, *op. cit.*, p. 8.
  - (iii.) *Hippotigris quagga quagga* (Gmelin), sex not stated, 64.7.2.3 (1449 a), *op. cit.*, p. 21; Flower, 1929, p. 251, where it is said to be a male.
  - (iv.) *H. q. burchelli* (Gray), sex not stated, 50.11.92.63 (854 b), *op. cit.*, p. 22.
  - (v.) *H. q. boehmi* (Matschie), ♂, 1933.5.24.1.
  - (vi.) *H. q. boehmi* (Matschie), ♀, 1933.5.24.2.
- These two specimens were collected in the Balbal depression, near Olduvai.
- (vii.) *H. zebra zebra* (Linné), sex not stated, 46.3.23.10 (706 a), *op. cit.*, p. 35.
  - (viii.) *Asinus asinus africanus* (Fitzinger), sex not stated, 4.6.12.1, p. 37, fig. 16.
  - (ix.) *A. a. somaliensis* (Noack), sex not stated, 86.12.17.1 (740 f), syntype of the subspecies, *op. cit.*, p. 39.
  - (x.) *A. kiang* (Moorcroft), sex not stated, 976 e, *op. cit.*, p. 10.
  - (xi.) *A. onager hemippus* (Geoffroy), sex not stated, 67.12.3.1 (705 b), *op. cit.*, p. 14.

I have included the Kiang and Onager in the genus *Asinus* rather than in *Equus*, because their limbs and teeth show a series of characters which, in the sum, are

much nearer to those of the Ass than they are either to the Horse or to the Zebras.

The fossils are in the Geological Department; the numbers in brackets are those which they bear in the Registers of the Department.

**HUMERUS.**—The humeri of the three groups of Recent monodactyl horses—Horses, Asses, Zebras—resemble each other very closely, and differ no more from the humerus of *Hipparion* than they do from each other. The main feature of classificatory value is the scar to which the infraspinatus muscle is inserted. According to the shape of this scar the Recent species form three groups, thus :

(i.) Group of *Equus caballus* Linné, as exemplified by Przewalsky's Horse. The insertion is a long triangle with the apex downwards. The antero-superior angle is almost a right-angle, but all the corners are rounded off, so that the scar has a tongue-like outline. Among some domesticated breeds, *e. g.*, an English thoroughbred, the scar becomes broader, but the side nearest the upper margin of the tuberosity is always the shortest. In the shape of the scar, and in many other features, there is a close resemblance between Przewalsky's Horse and the feral pony of the New Forest; a resemblance which is closer than that of more domesticated breeds.

(ii.) Group of the Zebras. In this group also the scar is still shaped roughly like a right-angled triangle, but the two sides which subtend the right-angle are of about the same length.

(iii.) Group of the Asses, including the Kiang and Onager. These forms have the scar short and concentrated, as it is in the Zebras, but the angles are so rounded that the outline is approximately semi-circular.

The earlier types of horse with more than one toe on each foot are not sufficiently well represented in the British Museum by uncrushed humeri for any definite groups to be segregated among them. One specimen of *Hipparion* from the Pontian deposits of Pikermi (M. 11229) appears to show that the infraspinatus muscle was inserted

to a concentrated scar similar to that of the Asses, but there are no better specimens to confirm this. In the more primitive genera the scar is hardly less specialised than it is in the higher forms; for example, the humeri of *Palæotherium crassum* (29744 a) and *Plagiolophus annectans* (29748) show distinct differentiation; both specimens were found in the upper Eocene deposits of Hordwell, Hampshire. In the former species the insertion of the infraspinatus is marked by a large semi-circular roughened area, which is slightly more rounded than the scar seen in *Asinus a. africanus*. In *P. annectans*, on the other hand, the scar is more sharply triangular, and, though relatively shorter, is not unlike the scar in *Equus caballus*. But when the very primitive *Hyracotherium vulpiceps* is considered, all resemblance to the more advanced horses is lost. A humerus (M. 10660) of this species, found in the London Clay of Harwich, shows a broadly oval, slightly concave scar at the posterior angle of the lateral tuberosity.

According to Kowalevsky (1873) and Filhol (1891) there is a progressive doubling of the bicipital groove as one passes from the more primitive equines to the more advanced. The humerus of *Hyracotherium* just mentioned has a simple groove with a deeply concave floor; it closely resembles that of many ruminants. The grooves of *Palæotherium* and *Plagiolophus* have never been described, neither is the material in the British Museum sufficient to enable me to do so. In *Anchitherium aurelianense* the floor of the groove has a gentle convex swelling (M. 2282). In *Hipparion* (M. 11229 b) the groove is double; the lateral portion is narrow and deep, whereas the medial portion is wide and very shallow. This is a logical development of the condition in *Anchitherium*. The monodactyl horses have the medial portion somewhat deeper than the lateral; they can be distinguished from *Hipparion* by this feature, but they are indistinguishable among themselves.

Other characters of the proximal end of the humerus may be used to group the monodactyl horses. As an example we may take the area of insertion of the subscapularis muscle to the medial tuberosity. This area is linguiform, elongate, and broadens towards its distal

end. Among the group of *Equus caballus* it is fairly narrow, with its axis inclined at a relatively small angle to the long axis of the shaft, but the Asses and Zebras agree in having a scar which is much broader at its distal end, and in which the angle of inclination to the long axis of the shaft is markedly oblique. *Hipparion* (e. g. M. 11229) has a much broader scar than any of the monodactyl horses, although the angle of inclination is about the same as that of the Asses and Zebras. This feature is not preserved in any of the specimens of *Anchitherium*, *Palæotherium*, or *Plagiolophus* in the British Museum collections.

The torsion of the shaft, the shape of the deltoid tuberosity, and of the teres tubercle are all variable. The torsion can be estimated only on complete bones; it is most easily seen by placing them on the table so that they rest on the back of the head and the two epicondyles. When a series so arranged is looked at from above, the teres tubercle is plainly visible in the Caballine group, but in the groups of the Asses and Zebras it is more on the side of the bone, and is seen in half-profile. The distinction is not absolute, for, although the teres tubercle becomes increasingly visible as one passes from the Zebras through the Asses to the Caballine group, yet individuals occur in which this character resembles that of the next higher group. For example, the African Ass (4.6.12.1) resembles the Przewalsky stallion (7.5.15.2). The tubercle is partly abraded in the four best specimens of the humerus of *Hipparion* found at Pikermi (M. 11224, M. 11225, M. 11229 *a*, M. 11229 *b*), but it appears to have been comparable with that of the Zebras.

The development of the torsion can be traced when a series of morphological stages is examined in the same way. *Hyracotherium* has a deltoid ridge but no distinct tuberosity; no teres tubercle is now visible because a fracture filled with matrix passes through the shaft at this point. The upper portion of the shaft of the humerus in *Palæotherium* is more advanced in its general appearance than it is in *Hyracotherium*. It has a prominent deltoid tuberosity separated from the teres tubercle by a wide, flat expanse of bone; tubercle and tuberosity are at about the same level. When the bone rests on the table in the

manner already described. the tuberosity faces obliquely upwards and the tubercle is out of sight facing obliquely downwards on to the table. On the material available, *Hipparion* cannot be separated from the Zebras. The teres tubercle is below the level of the deltoid tuberosity in both.

The backward and lateral growth of the medial epicondyle does not seem to affect these phenomena very greatly. To bring the tuberosity and tubercle of *Palæotherium* into the same position relative to the table as those of a monodactyl horse, the bone must be turned over on its side.

The teres tubercle is a very long narrow scar in *Palæotherium* (29744 a) ; it is shorter, wider, and more elevated above the general level of the bone in *Hipparion* and the Zebras : still shorter in the Asses ; and shortest and widest in the Caballine group. As it develops from a scar to a tubercle, it occurs at progressively lower levels on the shaft until in the Caballine group it is some little distance below the deltoid tuberosity, which is plate-like in the groups of *Equus caballus* and the Asses, but more slender and hook-like among the Zebras and *Hipparion*. This is not an absolutely reliable distinction, the specimen of Kiang examined has a tuberosity of the Zebrine type.

The distal end of the humerus is very nearly the same in *Anchitherium* as in the higher equine types ; Kowalevsky (1873) has discussed this point in some detail. Such differences as may be detected between the higher types themselves often appear to be individual ; nevertheless, *Hipparion* does tend to have a smaller pit for the medial ligament and a shallower depression for the lateral ligament, with a greater amount of cartilage on the condyle, than do the monodactyl horses. The antero-posterior measurements of the condyles and epicondyles are relatively less in *Anchitherium* than in the higher equines.

The distal end of the humerus of *Palæotherium* more closely resembles that of the Tapirs than that of the horses, and equine characters are but feebly developed, but there is no supra-trochlear foramen, whereas in some Tapirs (cf. *T. bairdi*, 79.9.17.2) this foramen is large (perhaps an individual character) ; moreover, the medial ligament is attached to a well-developed prominence

in the Tapirs, but to a pit on an indistinct elevation in *Palæotherium*. *Plagiolophus*, on the other hand, is more clearly equine in its characters.

Owen (1858) says that *Hyracotherium* has a supra-trochlear foramen. The specimen which he described (M. 10660) is damaged distally, and both coronoid and olecranon fossæ are filled with matrix. A hole has been bored through from one side to the other in an attempt to see whether a plate of bone was present. Presumably none was detected by this crude method, but against this must be set Cope's failure to mention such a foramen in his description of the humerus of *H. venticolum*; neither is one indicated in his figure (1884, pl. xlix. fig. 2).

**RADIUS AND ULNA.**—The story of the evolution of the equine forearm is largely one of the enlargement of the radius at the expense of the ulna.

The radius and ulna of the English *Hyracotheres* are not known from well-preserved material. The American species *H. venticolum* was described by Cope (1884); the radius is about as long as the humerus, its cross-section in the middle is a flattened oval which measures 9 mm. transversely and 5 mm. from back to front. There are no grooves for the extensor tendons on the anterior surface of the distal end, and the facet for articulation with the scaphoid is very little recurved posteriorly. No information is given about the attachments of the muscles and ligaments.

In *Palæotherium crassum* the radius and ulna (29744 b, c) are still separate. The proximal end of the radius is very like that of *Hyracotherium*; the lateral portion is still "an aliform projection with an acute external border" (Cope, *loc. cit.*), but the insertion of the biceps has already left the ulna and now forms a roughened area on the antero-medial margin of the radius; there is a wide, flat groove for the brachialis muscle, with roughened, slightly depressed areas above and below for the two parts of the medial ligament of the elbow. Distally there are wide deep grooves for the extensor tendons. The scaphoid facet is curved backwards and medially.

The ulna was intimately connected with the radius by means of strong interosseous ligaments. It was



fixed in relation to the radius so that the forearm had lost the power of pronation and supination. This is proved, not only by the nature of the connections between the two bones, particularly between their proximal and distal ends, but also by the course of the groove for the volar interosseous vessels and nerve. This groove descends the radius under cover of the ulna in such a manner that any change of the relative positions of the two bones would inevitably pinch the vessels and nerve. The distal articular surface is wider than deep. The facet for the pisiform is curved backwards, but is distinct from the facet for the cuneiform to which it is situated laterally and posteriorly.

*Anchitherium* (Filhol, Kowalevsky, *opp. cit.*) is much more horse-like in its characters. The proximal extremity of the radius (M. 2285) is similar to that of *Hipparion*. It is widened transversely so that the lateral tuberosity is salient, and the articular surfaces for the humerus have all the characters of *Hipparion*, but the transverse extent of the ulnar facet (42 mm.) compared with that of the humeral facet (50 mm.) is greater in *Anchitherium* than it is in either *Hipparion* (35 : 63, Regd. M. 11233) or *Stylohipparion* (44 : 70, Regd. M. 14482). Both Filhol and Kowalevsky say that there is no transverse expansion of either the upper or the lower end of the radius, but this would seem to be an individual feature. In my opinion the specimens figured by Blainville (1846, pl. vii.) have expanded ends, although the proximal end is not so wide as the specimen in the British Museum. The insertion of the biceps is large and concave on the medial margin of the bone, forming a low tuberosity where it encroaches on the anterior surface. The distal end is almost identical with that of *Hipparion*. The epiphysis is somewhat wider than the shaft, but the relative width is less than it is in *Palæotherium*. The grooves for the extensor tendons are well marked; the scaphoid and lunar facets have the typical equine form.

The *Anchitheriine* ulna is still further reduced; it is united with the radius in its distal portion. As figured by Kowalevsky (pl. i. fig. 47 a), the distal articular surface does not appear to differ very greatly from that of *Palæotherium*.

De Christol (1852), Lavocat (1852), and Hensel (1860) showed that in *Hipparion* the shaft of the ulna is entire, and that its limits on the conjoined bones are marked by grooves. This is also the condition in *Stylohipparion* (M. 14482), where the lower portion of the shaft may not be so much reduced as in certain specimens of *Hipparion* found at Pikermi (M. 11233). Although it is by no means a universal rule, the presence of an entire ulna in *Hipparion* and of an incomplete one in the monodactyl horses is probably the best means of separating them, but it must be borne in mind that in some specimens of the latter, particularly in domesticated breeds, the shaft of the ulna may be entire, whereas in some specimens of *Hipparion* (M. 11231) the ulna is incomplete.

Other characters have been suggested as suitable for separating the monodactyl horses from *Hipparion*. Hensel (1860) was of the opinion that the facets which articulate with the scaphoid and cuneiform bones project backwards more sharply in *Hipparion* than in *Equus*, and Forsyth Major (1880) said that this is also true of the Ass. Of the two specimens each of Przewalsky's Horse and Boehm's Zebra in the British Museum, one of each species has a distal articular surface of the radius of the *Hipparion* type, whereas the other specimen is of the Equine type. Similarly, although Kowalevsky's table (*op. cit.*, p. 14) represents a general tendency to the reduction of the ulna, there are certain specimens to which it does not apply. For example, in one specimen of *Hipparion* (M. 11233) the width of the ulna is 55 per cent. of the width of the proximal articulating surface of the radius; in *Stylohipparion* (M. 14482) it is 63 per cent.; in the male Boehm's Zebra it is 68 per cent.; in the Mountain Zebra it is 66 per cent.; and in the male Przewalsky's Horse it is 55 per cent. On account of the wide variation to which they are liable, the shape of the insertion of the ulnar collateral ligament, and the relationship of the two branches of the radial collateral ligament to the insertion of the brachialis muscle, are equally unsatisfactory as means of identification.

OS SCAPHOIDEUM.—The scaphoid bone of the equine carpus has the same type of evolutionary history as the

other bones shortly to be described. Nevertheless, both it and the lunar differ from the magnum in that the flattening process has not been carried so far, that the consequent simplification is almost entirely restricted to the distal surface, and that the relief of the proximal surface gradually became more pronounced.

The scaphoid of *Hyracotherium* "is the largest bone of the proximal row. Its radial facet has a greater antero-posterior than transverse diameter, and there is a short tuberosity behind it. Its trapezoid facet is a little larger than that joined by the magnum" (Cope, *op. cit.*, p. 642).

In *Palæotherium* the bone is roughly cuboid in shape with a well-marked tuberosity on its postero-superior surface. The radial facet is more-or-less semi-circular in outline with a pointed beak projecting laterally; it is convex in front and concave behind, and the beak is situated just where the convexity passes into the concavity. The lateral surface bears two facets for the lunar; of these the upper is claw-shaped, broad and rounded behind, and pointed in front (*P. stehlini*, 30028; *P. crassum*, 29744). The lower facet for the lunar is irregular in shape; it is flat (*P. stehlini*) or convex (*P. crassum*) in front, narrower and concave (deeply so in *P. crassum*) in the centre, and flat (*P. crassum*) or slightly concave and twisted (*P. stehlini*) behind. The inferior surface is occupied by two facets separated from each other by a sharp ridge; the medial facet is for articulation with the trapezoid, and the lateral facet for articulation with the magnum. The medial, trapezoidal facet is concave from side to side; from before backwards it is in three parts, of which the anterior convex portion passes into a central concave portion (much deeper in *P. stehlini* than in *P. crassum*), which in turn passes into the plane or very gently concave posterior portion. The facet for the magnum is divided into two parts by a deep pit for the interosseous ligament. The anterior portion is sub-rectangular in outline and concave from side to side, whereas the posterior portion is triangular with the apex forwards, and concave from front to back. There is a small, variable, irregularly-shaped facet on the inferior margin of the postero-medial surface; this is for the trapezium.

In *Meshippus bairdi* (Leidy) the scaphoid (M. 5752) is of the general type seen in all equines with three toes or less. Its greatest diameter is from back to front; the radial facet is convex in front and concave behind, without the lateral beak of *Palæotherium*; the superior facet for the lunar is damaged in the only specimen seen, but the inferior facet, which consists of two planes slightly inclined to each other, represents the anterior portion only of the corresponding facet in *Palæotherium*. The inferior surface resembles that of *Palæotherium* in so far as the facets are separated by a sharp ridge, in other respects it is equine; the pit for the interosseous ligament has been displaced to the postero-lateral corner of the articulating surface; the facet for the magnum has lost its hinder portion and is practically flat; the facet for the trapezoid is deeply concave, and corresponds to the median portion of the three-fold facet of *Palæotherium*. There is a facet for the trapezium on the distal margin of the posterior surface; it is plane, sub-triangular, and fairly large ( $3 \times 5$  mm.). The tuberosity covers the whole of the posterior surface and is reflected outwards so as to form a strong, nearly vertical ridge on the posterior margin of the lateral surface.

The scaphoid of *Anchitherium* (M. 2417) is only a little more advanced than that of *Meshippus*. The relief of the radial facet is more pronounced; the distinction between the facets for the magnum and the trapezoid is not so sharp; the inferior facet for the lunar is further developed, with a concave posterior portion which passes on to a small beak; there is a distinct pear-shaped facet for the trapezium.

The scaphoid of *Hipparion* has the same anatomical features with but slight changes in detail. The inferior facet for the lunar may have a simple, almost plane surface (M. 10083, from Concud), or it may have a plane anterior portion and, at an angle to this, a posterior portion which is plane (33632, from Cucuron), slightly concave (49704, M. 14732, from Pikermi), or deeply concave (M. 3990, M. 3992, from Maragha). The ridge on the distal surface which forms the boundary between the facets for the magnum and trapezoid is generally absent, and, in any event, very much less than it is in *Anchitherium*. The posterior tuberosity is very variable.

It may be like that of *Anchitherium* but a little stouter (M. 14732), or it may be of similar size and stoutness but slightly sloping backwards and downwards (M. 3992), or else it may be very stout with a pronounced backwards and downwards slope (49704, 33632, M. 10083).

The average monodactyl horse has a scaphoid which is difficult to separate from that of *Hipparion*. The only semi-constant character observed in a series of six bones of *Hipparion* and fourteen from fossil and Recent monodactyl horses is in the shape of the inferior facet for the lunar. The general type of facet in *Hipparion* consists of two parts of about the same size inclined to each other at an angle of approximately  $150^{\circ}$ , whereas in the monodactyl horses the hinder portion is much smaller and the angle is about  $90^{\circ}$  to  $120^{\circ}$ . As a rule the posterior tuberosity of the Asses and Zebras resembles that of *Hipparion* as represented by the specimens 33632, M. 3992, whereas that of the Caballine group is more concentrated and forms a thickened knot in the centre of the posterior margin of the lateral surface. Exceptions occur among the Zebras, however: for example, the scaphoid of the skeleton of *Hippotigris zebra* has a posterior tuberosity which agrees fairly well with that of a scaphoid of *Equus caballus* (36605) found in the Pleistocene deposits of Grays, Essex.

OS LUNARE.—The lunar is a wedge-shaped bone which in the course of its development acquired a more complicated articulation for the radius, whereas the distal surface became more flattened and simplified. The medial articulations, also, became simpler, but those on the lateral surface underwent little alteration. According to Cope (*op. cit.*) the radial facet of the lunar of *Hyracotherium* "is a good deal wider than deep. The posterior tuberosity is large and compressed, but does not project as far posteriorly as the cuneiform."

In *Palæotherium* (30089) the facet for the radius is confined to the anterior half of the proximal surface; it is subrectangular in outline and strongly convex from back to front; the remainder of the proximal surface is occupied by a large tuberosity. The medial surface has three facets for articulation with the scaphoid. Of these the superior is claw-shaped with the base postero-inferior

in position ; it is adjacent to the facet for the radius. The inferior facets are separated by a pyramidal projection or beak ; they are roughly semi-circular, and concave from back to front. On the lateral surface there is a superior facet which is oblong in shape, plane, and which passes downwards and backwards adjacent to the facet for the radius. The inferior facet is pear-shaped, with the broad end posterior, horizontal, and concave from back to front. Both these facets articulate with the cuneiform. The distal surface is divided by an S-shaped ridge passing from back to front. The anterior convexity is directed towards the medial surface ; it bounds the ovate, gently concave facet for the unciform on the one hand, and the narrow anterior portion of the facet for the magnum on the other. The posterior half of the ridge bounds the deeply concave facet in which the posterior portion of the magnum is lodged.

Cope's figure (*op. cit.*, pl. xlix b, fig. 4 a) of the proximal surface of the first row of the carpus of *Hyracotherium venticolum* suggests that, although no mention is made of it in the text, the concave posterior half of the facet for the radius had begun to develop in that genus.

*Meshippus bairdi* (M. 5752) is more horse-like in the characters of the lunar bone. The radial facet is broadest in front ; its sides converge towards the rear, and the posterior margin is straight. The hinder, concave part of the facet is fully developed. The posterior tuberosity is smaller than in *Palæotherium*, and has been displaced to a more distal position. Viewed from the front, the lateral margin is higher than the medial, a primitive character which persists throughout the whole of the Equoidea and is shared with many other groups of mammals, such as the Artiodactyla and the Primates. The inferior surface is greatly flattened in comparison with *Palæotherium*, and the ridge which divides the facets for the magnum and unciform is straight ; of these facets the former is convex and the latter concave, whilst the hollow for the posterior projection of the magnum now occupies the whole of the posterior moiety of this surface. The medial surface bears a superior and an inferior facet for the scaphoid ; it has lost the postero-inferior facet of *Palæotherium*, and with it the beak on the inferior margin. The lateral surface still has two

facets for the cuneiform, but now the upper one is horizontal and parallel to the lower one.

*Anchitherium* differs from *Meshippus* in the facet for the magnum, which is relatively larger and more convex, and in the posterior tuberosity, which is more prominent.

*Hipparion* (33623, 33631, 49704, M. 14732) has a stouter lunar than *Anchitherium*. The proximal facet is wider in front, and is pointed behind, instead of being truncate as it is in the latter.

The chief anatomical difference between the lunar bones of the monodactyl horses and those of the species of *Hipparion* is that the distal recess for the posterior projection of the magnum is larger. No other difference appears to be constant.

Forsyth Major (1880) discusses Kowalevsky's account of the lunar of *Anchitherium*, and from it deduces that the facet for the unciform in the lunar of the *Caballine* group should have a similar extent to that seen in *Hipparion*. He says that this is actually the case, but that the facet is less oblique. He adds that in *Equus stenonis* (which belongs to the Zebrine group) the facet is more oblique and also narrower than it is in Recent horses; that horses from Quaternary deposits come between the two; and that the Donkey is nearest to *E. stenonis*. The longer series of specimens now examined shows that these distinctions are not constant. For example, a lunar of *Hipparion* from the Pontian of Cucuron (33623) has the facet for the unciform nearly parallel with the long axis of the bone, and agrees in this respect with a lunar of *E. caballus* from Kent's Cavern (M. 738), whereas a lunar of Przewalsky's Horse (7.5.15.2.) has the facet just as oblique as it is in a lunar of *Hipparion* from Pikermi (49704). The Zebras and Asses agree now with *Hipparion* and now with *E. caballus*. In other words, the obliquity of the facet for the unciform is a matter of individual variation.

OS MAGNUM.—In his account of *Hyracotherium ventricolum*, Cope (*op. cit.*) says that "the lunar and scaphoid facets of the magnum are subequal. It rises in a compressed arch posteriorly, and has the usual long, decurved tuberosity posteriorly." This condition differs from that of *Palæotherium*, in which the scaphoid facet is very

much larger than that for the lunar. In this latter genus the facet for the second metacarpal is large in the bigger species (e. g., *P. crassum*, 29744), but smaller in the smaller species, and in the species referred to *Plagiolophus*. The facet is separated from that for the trapezoid by a sharp ridge, but passes into that for the third metacarpal by a fairly gentle curve. The high compressed posterior arch, and the decurved tuberosity are well developed in both *Palæotherium* and *Plagiolophus*.

*Meshippus bairdi* (M. 5752) has a carpus of the true equine type. All the bones are recognisable as "horse bones," even though they still retain ancestral features in marked degree. The magnum is flattened from above downwards; the facet for the scaphoid faces directly upwards; that for the lunar upwards and outwards; and that for the third metacarpal is nearly flat. The facet for the second metacarpal is large, subrectangular in outline, and faces inwards and slightly downwards. It is about equal in size to the facet for the trapezoid, which faces inwards and slightly upwards. The posterior projection is more primitive. Its proximal surface is high and arched, forming an articular surface which, in the single specimen examined, is received into a corresponding hollow in the lunar, and which is not in contact with the scaphoid. The inferior part of the projection, the tuberosity of more primitive forms, is produced downwards into a short beak, so that the facet for the third metacarpal is deeply concave in its hinder part.

*Anchitherium* (M. 2416) has a flatter magnum than *Meshippus*. It has been described in detail by Kowalevsky, who regarded the flattening as a result of the great development of the third metacarpal, and who said that whereas in *Palæotherium* the posterior projection is lodged in a fossa formed by the scaphoid and the lunar, in *Anchitherium* it is lodged in the lunar alone. But there would appear to be exceptions, for in the specimen examined the ridge dividing the scaphoidal and lunar facets is carried up over the projection in such a way as to indicate that the medial surface of the projection articulated with the scaphoid.

In *Hipparion* the magnum is flattened as in the one-toed horses, and the anatomical characters are similar. The posterior projection usually articulates with the



lunar alone, but in certain specimens (M. 8279, M. 14732) it also articulates with the scaphoid, which then bears a corresponding facet (cf. M. 14732). The division of the facet for the trapezoid into two parts separated by a rough horizontal groove, a process which was first seen in *Anchitherium*, has progressed further.

As a rule the monodactyl horses differ from *Hipparion* only in the development of a third facet for the trapezoid; this is on the posterior projection. According to Kowalevsky it is absent in *Hipparion* and present in *Equus*. Forsyth Major showed that it is sometimes absent in *Equus stenonis* (a Zebra), and is generally absent in the Donkey. It may or may not be present in Boehm's Zebra (present in 1933.5.24.1; absent in 1933.5.24.2); very small in Przewalsky's Horse (7.5.15.2.); and so small as almost to escape detection in the Mountain Zebra (706 a). On the other hand, a prominence on the medial surface of the posterior projection of a magnum of *Hipparion* from Cucuron (33625) seems as though it must have been in contact with the trapezoid, but it is not sufficiently well preserved to afford undoubted proof that the articulation was really present.

The facet for the second metacarpal does not appear to have any systematic value. It may be absent in *Hipparion* (M. 14732), the Kiang (976 e), and the Donkey (Forsyth Major, *op. cit.*), but it is generally present in all monodactyl horses and may be very large (a particularly good example is a magnum of the Zebra *Equus oldowayensis*, M. 14979).

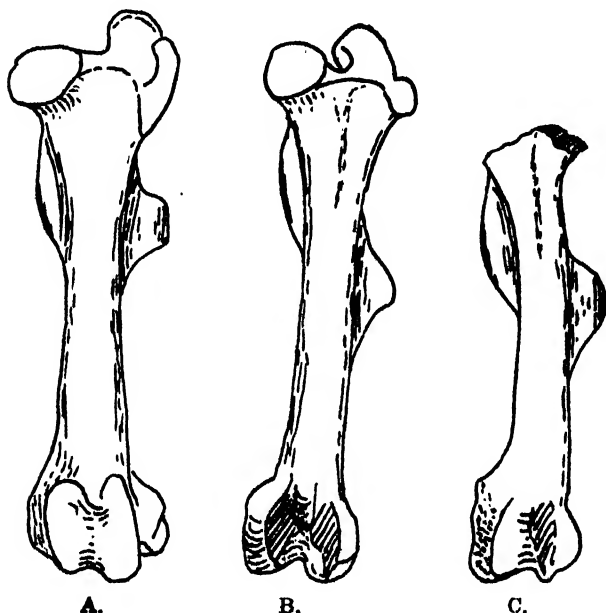
**METACARPUS.**—The differences between the various stages of evolution of the equine metacarpals have long been known, and study of longer series than those mentioned in earlier literature yielded nothing that was fresh, even as regards individual variations, or of systematic value.

**FEMUR.**—There is general agreement among the authorities that it is not possible certainly to separate the femur of *Hipparion* from those of the one-toed horses. Examination of the femora of earlier forms revealed an astonishing degree of uniformity throughout the whole of the Equoidea, a point which is well indicated by the

figures. In them the drawings A are of the left femur of Przewalsky's Horse; those marked B are of a small femur, probably *Anchilophus*, found in the Quercy Phosphorites; and those marked C are reversed drawings of a right femur of *Plagiolophus annectans* found at Hordwell.

Kowalevsky pointed out that in *Anchitherium* the great trochanter has moved to a position posterior to that

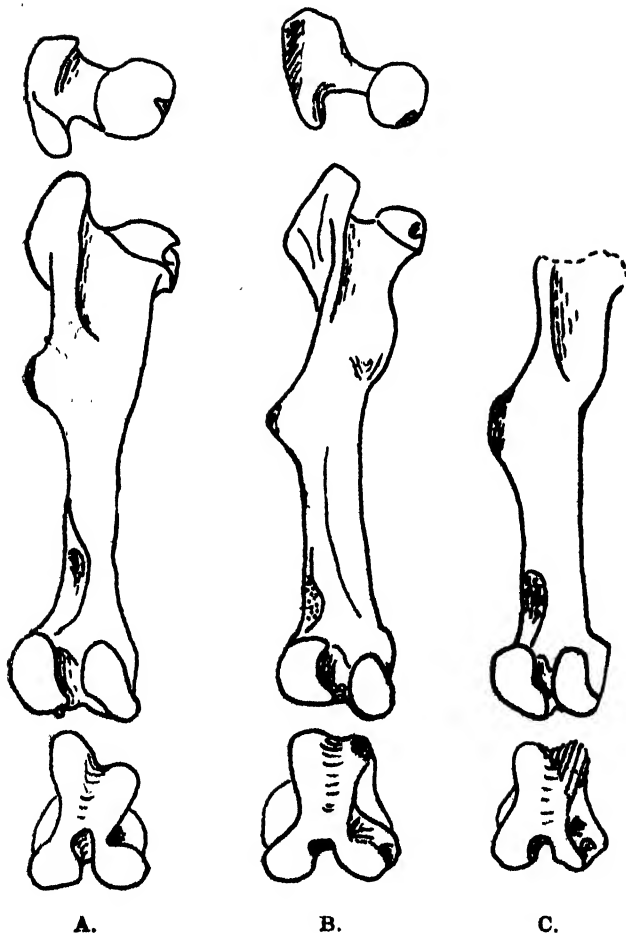
Fig. 1.



Comparative front views of the femora of Przewalsky's Horse (A), *Anchilophus* (B), and *Plagiolophus* (C). All drawn to the same length.

which it occupies in *Palæotherium*, and that within the *Palæotheres* the species *Plagiolophus minor* has carried the process further. But the change in position had been begun long before, for even in *Hyracotherium* the femur (regd. 44115 a) has the great trochanter roughly divided into two parts, the larger of which is situated well behind the transverse axis of the proximal end of the bone. As

Fig. 2



Comparative drawings of the same specimens as in  
fig. 1 from above, behind, below.

it progressed, this twisting carried the third trochanter round as well, and when the stage of *Anchitherium* was reached the trochanters had already attained the positions they occupy in later horses. Kowalevsky also gives a table which purports to show that the torsion is not yet complete in *Anchitherium*, but I have not been able to discover his points of measurement and so to check his observations. In any event the difference is small, and the fact still remains that the femur of *Anchitherium* resembles that of the later horses more closely than it does those of the *Hyracotheres* and *Palæotheres*.

Since the femora of the Miocene horses so closely resemble those of the Recent species, it is not surprising that those of *Hipparion* are almost indistinguishable from the bones of the later forms, and that it was found impossible to group the Recent bones on the limited material available to me. Branco (1883) published tables of measurements designed to show that there are slight differences of proportion between the Donkey and the Horse, the former being more slender than the latter. Rüttimeyer (1863) suggested that there are faint anatomical differences between the third trochanter of *Hipparion* and that of *Equus*. Gaudry (1864) was inclined to agree with Rüttimeyer, and the material in the British Museum, much of it imperfect, also indicates that slight differences do, in fact, exist between the two genera.

**TIBIA.**—In *Anchitherium* the posterior surface of the proximal end of the shaft is occupied by a fossa which extends across the whole width of the bones, whereas in the Horse the same area is almost flat (Kowalevsky, *op. cit.*). This fossa gradually becomes less evident as one passes upwards from *Hyracotherium*, and none of the tibiae of one-toed horses, whether Recent or fossil, has so deep a hollow as the only uncrushed specimens of the tibia of *Hipparion* (M. 11251, M. 14772) in the British Museum collections. In *Hipparion* and all later forms the floor of the fossa is flat, but it was not clear whether the gradual disappearance of the fossa was due to the reduction of the buttresses which flank it, or to the gradual raising of the floor to the level of the crests of the buttresses. In view of the alterations which took place in the stresses to which the bones were subject as the feet

altered from polydactyly to monodactyly, the latter seems to be more probable.

In all genera from *Anchitherium* upwards the inferior tibio-fibular joint is a bony union, but in lower forms the union is sometimes fibrous and sometimes bony. Apparently this variation is dependent on the age of the animal rather than on anything else. Indications are not wanting that in certain specimens of *Plagiolophus* the shaft of the fibula may have been incomplete, but this point needs further investigation. The upper end of the fibula seems as though it is normally free in all the genera examined. Every undamaged tibia seen has a facet for articulation with the upper end of the fibula, and one specimen of *Palæotherium crassum* (29746) from Hordwell, which displays a solid bony union of the lower joint, proves that although the top of the fibula is missing it was not united with the tibia but articulated with it by means of a smooth facet.

ASTRAGALUS.—Some years ago (1937) I discussed the differences between the astragali of the Recent horses and *Hipparion*, showing that although there are some astragali of wild horses—be they of Horse, Ass, or Zebra—which are not to be distinguished from certain astragali of *Hipparion*, one can generally separate the two types. There is rather more difficulty in distinguishing *Hipparion* from *Anchitherium*, and it is to be remembered that both these genera were tridactyl, but of the astragali of *Palæotherium* and *Plagiolophus*, the former resemble the Tapirs whereas the latter resemble the horses.

GENERAL OBSERVATIONS.—The descriptions of the long bones help to confirm the three rules drawn from a study of the humerus and femur of some East African antelopes (Hopwood, 1936), namely :

(i.) In any land mammal, the bones of the fore-limb are more characteristic than those of the hind-limb.

(ii.) In any long bone, the proximal end is more characteristic than the distal.

(iii.) In any limb, the nearer the bone is to the trunk the more characteristic it is.

Whether the first and second rules apply to the metapodials cannot finally be decided without examination of much longer series than I have had to deal with. The bones of the wrist and ankle of fossil species are not usually collected in sufficient numbers to allow valid conclusions to be drawn from them. Those found at Olduvai, Tanganyika, are a good illustration of this. There every piece of bone which afforded the least chance of identification was saved; of the Equoidea there were fourteen specimens of the astragalus, seven of the magnum, six of the calcaneum, and one each of the lunar, navicular, and scaphoid. Except that specimens of the magnum were unusually abundant, these figures reflect very fairly the frequency of these bones in collections.

In an appendix to the same paper, brief reference was made to the sexual differences in the limb-proportions of the wild horses; it was pointed out that the third metatarsal of the stallion is shorter than the humerus, whereas in the mare it is longer. This can be applied to six out of the seven Recent skeletons of which Lydekker did not record the sex; the seventh, that of *Asinus onager hemippus*, has none of the feet preserved. The following table contains the least length between articular surfaces of the humerus and metatarsal, the proportions (in italics) and the sex inferred:—

	Humerus.	Mt. III.	
	mm.	mm.	
<i>Hippotigris quagga quagga</i> . . .	227	210	
	100	92.5	Male
<i>H. q. burchelli</i> . . . . .	240	223	
	100	92.9	Male
<i>H. zebra zebra</i> . . . . .	234	219	
	100	93.6	Male
<i>Asinus asinus africanus</i> . . . .	246	229	
	100	93.1	Male
<i>A. a. somaliensis</i> . . . . .	218	228	
	100	104.6	Female
<i>Asinus kiang</i> . . . . .	213	232	
	100	108.9	Female

It is worth notice that the difference in length between the two bones appears to be more constant in the males than in the females; in default of additional material, I am not disposed to attach any special significance to it.

The present notes, incomplete though they are, show that certain of the anatomical characters of the bones of

Horse, Ass, and Zebra are diagnostic of those groups. Taken together with the various patterns of the cheek-teeth, they justify separation of the groups as distinct genera. The shape of the scar to which the infraspinalis is inserted, or of the groove between the metaconid and metastylid (*cf.* Hopwood, 1937) cannot be regarded as adaptations within a group so compact in structure and habits as the Equidae, but they are just the kind of character which separates lines of descent. In other words, they are "heritage" characters, not "habitus" characters, and therefore of considerable systematic importance.

So far as the Palæotheriidae are concerned, it is clear that they need thorough revision. Not only is it necessary to determine the types of the Cuvierian species (*cf.* Depéret, 1917; Stehlin, 1938), but the bones of all the genera must be studied in detail, for it is clear that despite the manifold adaptations to which the mammalian limbs have been subjected there is always a considerable residuum of primitive characters which often enable the systematist to establish natural groupings of generic rank. Indeed, instances are known in which it is rather more easy to separate genera on their osteology, than on the characters of the teeth, but they have not yet been found among the Equoidea.

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X.—On the Cœnosiinæ of the Fiji Islands (Diptera: Muscidae). By F. I. VAN EMDEN (Imperial Institute of Entomology).

IN his extremely useful 'Diptera Brachycera and Athericera of the Fiji Islands' (London, 1928, p. 168–173), Bezzi mentions two *Cœnosia*, one *Pygophora*, three species of *Atherigona* and the widely-distributed *Orchisia costata* Meig. From an examination of Bezzi's types made in the course of routine work, a few additions and corrections have become necessary.

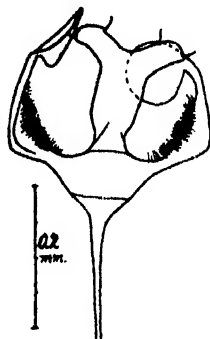
*Atherigona excisa* Thoms. var. *trilineata* Stein and *pæcilopoda* Bezzi belong to the *excisa*-group (=subg. *Acritochæta* Grimsh., characterized in the male sex by the preapical emargination of the dorsal surface of the fore femora, simple palpi, and the absence of a hypopygial prominence, in the female by long-clavate palpi), whereas *splendens* Bezzi belongs to *Atherigona*, s. str. (palpi of male with some black setulæ at base of dorso-exterior surface, hypopygial prominence and trifoliate process present, front femora simple, palpi of female band-shaped). The hypopygial prominence of *splendens* is rather small, shortly bifurcate, the two branches rather slender. The trifoliate process is shown in fig. 1. In both sections, represented on the Fiji Islands, the postero-ventral preapical seta of the fore femora and the lower sternopleural are present.

*Pygophora ctenophora* Bezzi has the normal strong postero-ventral submedian seta on the fore tibiæ, in addition to the two setæ mentioned by Bezzi which are small and on the antero-dorsal surface. The former seta is present in all the published species of *Pygophora*, but the species of subg. *Cephalispa* Mall. have the frons of a *Pygophora* (see Emden, 1940, B.M. Ruwenzori Exp. ii. p. 96), while being devoid of the fore-tibial seta. They are transitional towards *Lispocephala*, and have been included in the latter genus by Malloch. The mid-tibiæ of *P. ctenophora* have two postero-dorsal setæ, of which particularly the proximal one is very small in the male.



The mid-femora possess, in the female sex, a continuous, not very conspicuous antero-ventral and postero-ventral row of fine small setæ on apical half. In the male the postero-ventral surface is adorned from two-thirds to three-quarters of the length with a loose patch of black setulæ, which gradually become longer towards apex and briskly cease at three-quarters, the last quarter of the postero-ventral surface being entirely bare, even of the ordinary short hairs, except for a few fine setulæ at the extreme apex (fig. 2). This peculiar clothing was some-

Fig. 1.

Trifoliate process of *Atherigona splendens* Bezzi.

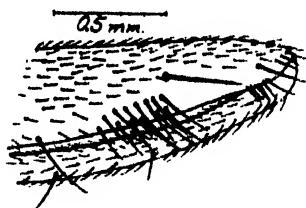
The apex of the lateral part twisted on the right side and partly shown by transparency of the median part. (Camera lucida with Leitz microscope, eye-piece 4, objective 3, scale 0.2 mm.)

what inadequately described by Bezzi as a subapical, comb-like row of short black bristles, an expression which would not suggest a double to multiple row. This character and the simple hind tarsi distinguish *ctenophora* Bezzi and *buxtoni* Mall. from *hirtimana* Mall. and an undescribed species. In *buxtoni*, from Samoa, the wings are faintly clouded on the apical half, whereas they are hyaline in *ctenophora*, and the lateral parts of the fourth abdominal tergite are somewhat differently haired in these two species.

The two species described under *Cænusia* by Bezzi belong to *Lispocephala*, as was already assumed by

Malloch (1929, Ins. Samoa, vi. p. 152). Unfortunately, Bezzi has mistaken the females of *dolichocera* Bezzi for males, and described them as *microlepis*, expressly designing a male and female from Taviuni as types. These are both females and conspecific with *dolichocera*, *microlepis* ♀ thus being a synonym of *dolichocera* ♂. The smaller measurement given by Bezzi refers to them. The female from Cuvu, of 3.5 mm., is the only specimen with a "short even ciliation on terminal half" of mid-femora. Mr. R. A. Lever has several times sent identical females and has more recently submitted a male with the same character. This species with a comb of short setulæ on apical half of mid-femora was described in the same month (1928, Proc. Hawai. ent. Soc. (7) i. p. 80, issued

Fig. 2.

*Pygophora stenophora* Bezzi.

Apical half of mid-femur and basal part of tibia, posterior view.  
(Camera lucida with Leitz microscope, eye-piece 2, objective 2,  
scale 0.5 mm.)

June 1928, whereas Bezzi's book appeared 23. 6. 28) as *Lispocephala tripuncta* Mall., to which *microlepis* Bezzi ♀ is a partial synonym.

The four genera of Cœnosiinæ and the two species of *Lispocephala*, found on the Fiji Islands, may be distinguished by the following key, all the characters in which apply to both sexes, though a few of them do not fit all the extralimital species :—

- 1 (2). Parafrontalia with one pair of reclinate setæ (in addition to the strong inner vertical). Two pairs of presutural dorso-

- centrals, which are inconspicuous and of subequal length. Front femora with a postero-ventral preapical seta, but without a complete row of postero-ventral bristles. Hind tibiae with one postero-dorsal seta. (Key to the species in Bezzi's paper.) . . . . . *Atherigona* Rond.
- 2 (1). Parafrontalia with two pairs of reclinate setae (in addition to the strong inner vertical). One strong pair of presutural dorsocentrals and often a much smaller pair in front of and rather close to the strong pair. Front femora with a complete postero-ventral row of bristles. Hind tibiae with two postero-dorsal setae.
- 3 (4). Frontal triangle not passing middle of frons. Interfrontalia yellow. Arista long-plumose in basal half, bare in apical half. Scutellum with two pairs of strong setae. Front tibiae with a submedian postero-ventral seta. (Only *P. ctenophora* Bezzi.) . . . . . *Pygophora* Schin.
- 4 (3). Frontal triangle reaching anterior margin of frons. Interfrontalia black, the fore margin sometimes reddish. Arista short-plumose throughout. Scutellum with the lateral pair of setae much smaller or absent. Front tibiae without a submedian postero-ventral seta.
- 5 (6). Scutellum with the lateral pair of setae distinct though (in Fijian species) much smaller than the apical pair. Hind tibiae with two postero-dorsal setae. Wings hyaline. Lower calyptra extremely small, much shorter than the upper one (in Fijian species) . . . . . *Lispocephala* Pok.
- a. (b). 2.5 mm. Mid-femora with the same short, half-appressed hairs along the postero-ventral edge as on disc . . . . . *L. dolichocera* Bezzi.
- b. (a). 3.5-4 mm. Mid-femora with a comb-like row of short erect setulae along postero-ventral edge, a similar though less dense and less conspicuous row along antero-ventral edge . . . . . *L. tripunctata* Mall.
- 6 (5). Scutellum with only the apical pair of setae. Wings blackish, except for hind and apical margins, which are milky. Lower calyptra projecting beyond upper one. (Only species: *costata* Meig.) . . . . *Orchisia* Rond.

XI.—*New Species of Chrysomelidæ, Halticinæ (Coleopt.)*, collected by Charles Darwin during the voyage of the 'Beagle,' 1832–1836. By G. E. BRYANT, F.R.E.S., Imperial Institute of Entomology.

IN the course of re-arranging and incorporating accessions to the collection of Chrysomelidæ in the British Museum, now contained in about 700 drawers and represented by over 7,000 types out of approximately 24,000 described species, I have come across in the accessions many minute species collected by C. Darwin during the voyage of the 'Beagle,' 1832–1836. These came to the British Museum through G. R. Waterhouse, and by purchase at the sale of the Entomological Society of London's collection in 1858. In August, 1841, Darwin presented some of the insects to the Entomological Society and some to the Zoological Society of London. The more valuable portions of both these collections eventually reached the British Museum (see the 'Centenary History of the Entomological Society of London,' 1933, pp. 88–89). From G. R. Waterhouse, the Museum received 2,500 specimens, Registered No. 1885–119 and 1887–42. Ent. Soc. Sale Reg. No. 1858–60.

G. C. Champion, in his paper in the Entom. Mo. Mag., 1918, p. 43, says in error that these came from C. O. Waterhouse. Judging from the number of minute specimens which Darwin collected, he evidently made good use of the sweeping net. During his few days at the Cape, he succeeded in obtaining two very interesting species, one of which has more recently been taken by W. Bevin (1906), and has remained undescribed. The majority in this paper were collected in South America, the Australian species having been previously dealt with by G. R. Waterhouse, and more recently by A. M. Lea.

I append a list of some of the papers dealing with some of Darwin's Coleoptera. The types of the new species are in the British Museum.

*List of papers dealing with Coleoptera collected by Charles Darwin on the voyage of the 'Beagle,' 1832-1836.*

- BABINGTON** (C. C.).—"Description of the species of Dytiscidæ collected by C. Darwin in S. America and Australia during the voyage of H.M.S. 'Beagle'." Trans. Ent. Soc. Lond. iii. 1841, pp. 1-13.
- CHAMPION** (G. C.).—"Notes on various species of the American genus *Astylus*, etc." Ann. & Mag. Nat. Hist. 9, vol. ii. 1918, pp. 337-367.
- CHAMPION** (G. C.).—"Notes on various S. American Coleoptera collected by Charles Darwin during the voyage of the 'Beagle,' with descriptions of new genera and species." Ent. Mo. Mag. 3rd series, vol. iv. 1918, pp. 43-55.
- CHAMPION** (G. C.).—"The Coleoptera of the Falkland Is." Ann. & Mag. Nat. Hist. vol. i. 1918, pp. 167-186.
- CHAMPION** (G. C.).—"Studies in Phalacridæ.—II. Asiatic and Tropical American forms." Ann. & Mag. Nat. Hist. 9, vol. xvi. 1925, pp. 601-621.
- HOPE** (F. W.).—"Descriptions of some species of Carabidæ collected by Charles Darwin, Esq., in his late voyage." Trans. Ent. Soc. Lond. ii. 1838, pp. 128-131.
- LEA** (A. M.).—"On some Australian Coleoptera collected by Charles Darwin during the voyage of the 'Beagle'." Trans. Ent. Soc. Lond. 1926, pp. 279-288.
- WATERHOUSE** (C. O.).—"On some new genera and species of Heteromorous Coleoptera (Helopidæ) from Tierra del Fuego." Trans. Ent. Soc. Lond. 1875, pt. iv. pp. 331-337.
- WATERHOUSE** (C. O.).—"Galapagos, 1835, C. Darwin." Proc. Zool. Soc. Lond. 1877, p. 80.
- WATERHOUSE** (F.).—"Falkland Islands." Journ. Linn. Soc. Zool. xiv. p. 531 (1878).
- WATERHOUSE** (G. R.).—"Descriptions of some new species of exotic insects." Trans. Ent. Soc. Lond. ii. 1838, pp. 188-196.
- WATERHOUSE** (G. R.).—"Galapagos and Charles Is." Ann. & Mag. Nat. Hist. vol. xxi. 1848, p. 39.

WATERHOUSE (G. R.).—"Descriptions of some of the insects brought to this country by Charles Darwin." Trans. Ent. Soc. Lond. ii. 1838, p. 131.

Species of Halticinæ collected by Charles Darwin in South America :—

*Oxygona rufa* Clk.—Rio, 2 specimens.

*Lactica fromenti* Duv.—Rio, 3 specimens.

*Systema plagiata* Clk.—Rio, 1 specimen.

*Systema testaceovittata* Clk.—Maldonado, Uruguay, 1 specimen. Rio,

*Systema annulicornis* Philipp.—Chile, 1 specimen.

*Systema punctatissima* Jac.—Uruguay, 1 specimen.

*Procalus mutans* Blanch.—Valparaiso, Chile, 1 specimen.

*Disonycha bicarinata* Boh.—Maldonado, Uruguay, 6 specimens.

*Haltica janthina* Blanch.—Chiloe Is., 1 specimen.

*Haltica flavipes* Philipp.—Chiloe Is., 4 specimens.

*Diphaulaca ? volkameriæ* F.—Rio, 1 specimen.

*Haltica pallens* Blanch.—Gay. Hist. Nat. Chil. v. p. 558.

Chiloe Is., C. Darwin, 4 specimens. (Nos. 2369, 2370, 2371). Should be placed in genus *Crepidodera*.

*Haltica picea* Waterh.—Trans. Ent. Soc. Lond. 1838, p. 133, W. Australia. Placed by Gemminger in *Phyllotreta*; should go into genus *Epitrix*.

#### HALTICINÆ.

##### *Epitrix darwini*, sp. n.

Oblong-ovate, flavous, except the prothorax, which is metallic with a purplish tinge, and an irregular transverse fuscous band a little behind the middle of the elytra, the side margins of the elytra narrowly fuscous, prothorax strongly punctured, the elytra punctate-striate, pubescent.

Length 2 mm.

Head flavous, impunctate. Antennæ flavous, extending a little beyond the base of the prothorax, the first segment the longest and slightly club-shaped, about twice as long as the second, the second slightly more dilated than the

third, and about equal in length, the third to the eleventh all about equal, the apical segment acuminate. Prothorax metallic, with a purplish tinge, transverse, the sides slightly contracted in front, the anterior angles obtuse, a deep transverse impression in front of the basal margin, strongly and regularly punctured. Scutellum very small, subquadrate, impunctate. Elytra slightly broader at the base than the prothorax, rounded at the apex, flavous, a transverse irregular fuscous band behind the middle, the central portion of the band on each elytron expanding upwards, the side margins narrowly fuscous, strongly punctate-striate, pubescent. Legs entirely flavous. Underside with the ventral segments of the abdomen flavous, the first segment the longest, the second to the fourth short and about equal to each other, clothed with short golden pubescence.

URUGUAY: Maldonado (*C. Darwin*, No. 1310, 1885-119, 1 specimen).—Presented to the British Museum by G. R. Waterhouse; ARGENTINE: Villa Ana, 16. x.-7. xi. 1933 (*R. J. Hayward*), 4 specimens.

Allied to *E. tincticollis* Wse., n. n. for *E. æneicollis* Jac., from the Argentine, but differs in colour and pattern of the elytra.

*Epitrix uruguayica*, sp. n.

Ovate, convex, dark chestnut-brown with a metallic tinge, the colour varies to fuscous, antennæ and legs fulvous, the head impunctate, prothorax somewhat closely punctured, elytra punctate-striate.

Length 1.5 mm.

Head smooth, impunctate, the antennæ fulvous, extending slightly beyond the base of the elytra, the two basal segments more dilated, and the first nearly twice as long as the second, the five terminal segments slightly thickened. Prothorax deep chestnut-brown with metallic tinge, transverse, the sides parallel, with the anterior angles very obliquely truncate, somewhat strongly punctured, the basal transverse groove deeply impressed and sinuate in the middle. Scutellum impunctate, the apex rounded. Elytra deep chestnut-brown with metallic tinge, broader than the base of the prothorax, convex, the sides rounded behind the middle to the apex, trans-

versely depressed behind the shoulders, punctate-striate, the interspaces smooth, clothed with scattered golden pubescence. Legs and underside fulvous, impunctate, the first ventral segment of the abdomen longer than the following three segments together.

URUGUAY : Maldonado (*C. Darwin*), 7 specimens.

Allied to *E. nucea* Baly, from Brazil, but differs in having a depression at the base of the elytra, the prothorax more strongly punctured, and the elytra more parallel-sided and not so acutely rounded at the apex.

*Crepidodera bahiensis*, sp. n.

Ovate, entirely brownish yellow, head and prothorax impunctate, elytra punctate-striate.

Length 1.5 mm.

Head brownish-yellow, broad, impunctate, the eyes rather large, a well-defined longitudinal carina between the insertion of the antennæ, from the base of which an oblique impression extends on either side to the base of the eye. Antennæ brownish yellow, extending a short way beyond the base of the prothorax, the two basal segments more dilated, the first twice as long as the second, the second to the tenth all about equal, the eleventh slightly longer and acuminate. Prothorax brownish yellow, very transverse, impunctate, the sides almost straight, with the anterior angles strongly obtuse, a large and deep impression along the posterior margin, limited on either side by a small longitudinal depression. Scutellum small, triangular, impunctate. Elytra brownish yellow, slightly broader at the base than the prothorax, widest a little before the middle, narrowing very slightly towards the apex, and thence rounded, punctate-striate, the punctures large and round and close. Legs brownish yellow, all the tarsi with the first segment long and about equal to the second and third together. Underside brownish yellow.

BRAZIL : Bahia (*C. Darwin*, 1885-119), from G. R. Waterhouse.

Somewhat allied to *C. flavescens* Baly, from Brazil, but broader and not so tapering towards the apex, colour darker.



*Crepidodera chilensis*, sp. n.

Elongate ovate, bronze, with the exception of the antennæ and legs which are flavous, the posterior femora fuscous, head nitid, almost impunctate, prothorax somewhat strongly punctured, and the elytra punctate-striate.

Length 1.75 mm.

Head bronze, nitid, a few small punctures near the inner margin of the eyes, feebly longitudinally carinate between the insertion of the antennæ. The antennæ flavous, extending almost to the middle of the elytra, the basal segment the longest, nearly twice as long as the second, the second to the eleventh all about equal. Prothorax bronze, somewhat strongly and closely punctured, transverse, the sides almost straight, feebly margined, the anterior angles strongly obtuse, a transverse impression along the basal margin not extending to the sides. Scutellum bronze, impunctate, the apex rounded. Elytra bronze, slightly broader than the base of the prothorax, the sides almost parallel and rounded at the apex, punctate-striate, the punctures on the striæ near the suture finer. Legs flavous, with the posterior femora fuscous. Underside dark metallic bronze.

CHILE: Chiloe Is. (*C. Darwin*, Nos. 2523 & 2368), Reg. No. 1885-119.

Allied to *C. ænescens* Boh., from Brazil, but colour and puncturation different, and not depressed near the base of the elytra.

*Longitarsus chilensis*, sp. n.

Oblong, dark brown, head and prothorax slightly more reddish brown, the antennæ and legs fulvous, the head impunctate, the prothorax very finely punctured, the elytra strongly punctured.

Length 1.5 mm.

Head reddish brown, impunctate, the interantennal carina distinct. Antennæ fulvous, extending to the middle of the elytra, the first segment the longest, the remainder all about equal to each other. Prothorax reddish brown, slightly transverse, very finely punctured, the sides straight, all the angles oblique. Elytra dark brown, strongly punctured, the punctures not forming

striae, the sides feebly rounded, widest about the middle, gradually tapering and rounded at the apex. Legs fulvous, the posterior tibiae with a spine at the apex, and the first segment of the tarsus half as long as the tibiae. Underside slightly paler brown, the first ventral segment of the abdomen the longest, the second to the fourth short and about equal to each other.

CHILE: Chiloe Is. (*C. Darwin*), 3 specimens; (*Fry Coll.*), 3 specimens; (*Baly Coll.*), 1 specimen.

Allied to *L. amazonus* Baly, but the colour different, the elytra very much more strongly punctured, and the sides more rounded.

Up to the present, very few species of *Longitarsus* have been described from S. America, but there are a great number of very obscure species still undescribed in the British Museum.

*Longitarsus darwini*, sp. n.

Oblong, chestnut-brown, elytra with a slight metallic tinge, antennæ and legs fulvous, the posterior femora slightly darker, prothorax very finely punctured, the elytra with punctures confused and a little stronger.

Length 2 mm.

Head chestnut-brown, impunctate. Antennæ extending to the middle of the elytra, fulvous, the first segment slightly club-shaped and twice as long as the second, the remainder all about equal, the apical segment acuminate. Prothorax chestnut-brown, slightly transverse, very feebly punctured, the sides almost straight, with the anterior angles oblique. Scutellum very small, impunctate. Elytra chestnut-brown, with metallic tinge very finely and confusedly punctured, widest about the middle, then gradually rounded to the apex. Legs fulvous, with the posterior femora darker, the posterior tibiae with a strong spine at the apex, the outer margin of the tibiae finely toothed, the first segment of the posterior tarsi half as long as the tibiae. Underside fulvous.

URUGUAY: Maldonado (*C. Darwin*), 2 specimens.

Allied to *L. chilensis* Bry., but larger, the puncturation very much finer, and the sides of the elytra less rounded.

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*Aphthona bevinsi*, sp. n.

Broadly ovate, convex, entirely flavous, nitid, with the six apical segments of the antennæ darker, head and prothorax impunctate, the elytra very finely punctured.

Length 2 mm.

Head impunctate, flavous, nitid, frontal elevations indistinct. Antennæ long and slender, extending almost to the apex of the elytra, flavous, with the six terminal segments slightly darker, the first segment long, slightly club-shaped, and equal to the following two together, the third slightly longer than the second, and the remaining segments each about equal to the third. Prothorax flavous, nitid, impunctate, transverse convex, the sides rounded, and the anterior angles oblique. Scutellum flavous, nitid, impunctate, triangular. Elytra flavous, nitid, very finely punctured, very broad, broader than the base of the prothorax, the sides rounded, broadest about the middle, and then gradually rounded to the apex. Legs flavous, the posterior tarsi with the metatarsus as long as the following segments together. Underside flavous.

S. AFRICA : Cape of Good Hope (*C. Darwin*, No. 3691), Reg. No. 1885-119, 1 specimen ; Table Mt. (*W. Bevins*), Reg. No. 1906-167, 5 specimens.

This and the following species I think best to place provisionally in the genus *Aphthona*, as the hind tarsus is not as in *Longitarsus*. It is somewhat allied to *Longitarsus apicipes* Jac., which is not a true *Longitarsus*. The African species of *Longitarsus* and *Aphthona* need a complete revision.

*Aphthona capensis*, sp. n.

Oblong, castaneous, head impunctate, prothorax very coarsely but not closely punctured, elytra strongly punctate-striate.

Length 2.5 mm.

Head castaneous, impunctate, two oblique impressions on the vertex meeting at the base of the antennæ in the form of a V. Antennæ castaneous, extending to the middle of the elytra, the first segment longer and more club-shaped than the second, the second and third about equal to each other, the fourth and fifth equal to each other, but each longer than the third, the sixth to the

apical all about equal, each a little shorter than the fifth, the apical segment acuminate. Prothorax castaneous, transverse, the sides rounded and slightly contracted in front, the punctures large, irregular, and not close together. Scutellum castaneous, impunctate, triangular. Elytra castaneous, three times as long as the prothorax, strongly punctate-striate, very little broader at the base than the prothorax, the sides nearly straight, slightly wider behind the middle, then tapering to the apex. Legs castaneous, the posterior tarsi with the first segment equal to the second and third together.

S. AFRICA : Cape of Good Hope (*C. Darwin*), 2 specimens.

I place this provisionally in the genus *Aphthona*. It is a very distinct species, on account of its very coarse puncturation and its elongate tapering shape.

*Syphrea bahiensis*, sp. n.

Broadly ovate, very convex, head and prothorax rufous, the antennæ black, with the four basal segments rufous, the elytra blue-black, very finely punctured.

Length 3.5 mm.

Head fulvous, nitid, impunctate, longitudinally carinate between the base of the antennæ. Antennæ black, with the four basal segments fulvous, extending slightly beyond the base of the elytra, the first segment the longest, about equal to the two following, the four terminal segments slightly thickened and pubescent. Prothorax rufous, nearly twice as broad as long, the sides nearly straight, converging to the apex, the posterior angles acute, the anterior angles moderately produced; very convex, impunctate, a strong transverse sinuate groove across the base of the prothorax. Elytra dull blue-black, slightly broader than the base of the prothorax, very convex, parallel-sided, and rounded at the apex, very finely punctured. Legs black, posterior femora strongly incrassate. Underside with the prosternum rufous, the remainder deep blue-black.

BRAZIL : Rio de Janeiro and Bahia (*C. Darwin*), 2 specimens; (*Bowring Coll.*), 4 specimens.

Allied to *S. angustata* Jac., from Mexico, but much smaller, colour of elytra much darker and less metallic.

XII. *Stray Notes on Mallophaga*.—V.

By G. H. E. HOPKINS, M.A.\*

19. *A new subspecies of Pseudolipeurus*.

PIAGET (1880, p. 329, pl. 28, fig. 3) described and figured *Lipeurus longipes* from a male found on a skin of *Tinamus obsoletus* in Leyden Museum. Carriker (1936, p. 72, pl. 3, fig. 2) redescribed what he took to be the same form from *Crypturellus obsoletus punensis* from Peru and Bolivia, though noting that Piaget's type was probably from the Brazilian form of the host (*C. o. obsoletus*) and might prove slightly different; he placed the species in his new genus *Pseudolipeurus*. Clay (1937, p. 133) compared Piaget's type with Carriker's figure and found that in the type the hyaline frontal margin is bilobed, whereas Carriker's figure shows it entire. She was unable to decide whether the difference should be considered subspecific owing to the absence of adequate material.

I recently received from Professor F. Plaumann a collection of Mallophaga taken from *Crypturellus o. obsoletus* (Temm.) in southern Brazil, which included a good series of *Pseudolipeurus longipes* (Piaget). All these specimens have the frontal margin bilobed as in Piaget's type, and Miss Clay kindly compared one of the males with Piaget's type for me and found it identical. Meanwhile, Mr. Carriker has most kindly sent me two males and two females, comprising the whole of the material from which he redescribed the species except the single male from Calabatea, Rio Coroico, Bolivia, which is no longer in his possession. In all these specimens the hyaline frontal margin is practically straight, but in all of them it has a somewhat folded and collapsed appearance, so that I am unable to satisfy myself that the apparent absence of the two lobes is genuine. But there are other differences between the two forms, some of which appear to be constant, which convince me that they are sub-specifically distinct.

The most important difference is in the form of the male genitalia: the chitinous bars which strengthen the basal plate converge distally distinctly more strongly in Piaget's

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form, the parameres are decidedly stouter and more strongly bent than in the material from *C. o. punensis*, but the most striking difference is that the endomerall plate (of the same type in both forms) is proportionately very much shorter in the material from *C. o. punensis* than in true *longipes*; in the former it is little more than twice as long as broad and occupies slightly more than a half (seven-thirteenths) of the longitudinal space between the parameres, whereas in true *longipes* it is rather more than three times as long as broad and occupies nearly three-quarters (nine-thirteenths) of this space. Carriker has drawn attention (1936, p. 72) to the fact that in his form the head is decidedly narrower in the male than in the female, and that the female is much larger than the male; neither of these observations is true of *l. longipes*, in which the sexes are of almost exactly the same size and the cervical index is 1.33 in both sexes. The two pairs from *C. o. punensis* are by no means uniform in either of these respects, and I am not convinced that we are not dealing with three subspecies instead of two, but in the absence of more material it is safer to consider the two pairs from this host to be of one form; in each pair the head is narrower in the male than in the female and the female is much the larger insect. In the pair from Bolivia the cervical index is 1.5 in the male and 1.3 in the female, and the total length is 1.95 mm. in the male and 2.03 mm. in the female; in the Peruvian pair the cervical index is 1.3 in the male and 1.25 in the female, and the total length is 2.20 mm. in the male and 2.61 in the female. In true *longipes* the cervical index is 1.33 in both sexes, and the difference in total length is trivial (male 2.37 mm.; female 2.47).

I have much pleasure in naming Mr. Carriker's form *Pseudolipeurus longipes carrikeri*, ssp. n. The holotype male and allotype female (on one slide) are from *Crypturellus obsoletus punensis* (Chubb), Sandillani, Dept. La Paz, Bolivia, 25th November, 1934, and have been returned to Mr. Carriker. The pair of paratypes, which Mr. Carriker has very generously permitted me to retain, are from the same host, La Oroya, Peru, 6th and 12th June, 1931. All the specimens were collected by Mr. Carriker.

The fact that my males from *C. o. obsoletus* agree perfectly with Piaget's type strongly supports the sugges-

tion that the type of *Pseudolipeurus l. longipes* (Piaget) came from the nominotypical form of the host.

It will be noted that my measurements do not agree with those published by Carriker, although taken from the same material. My measurements were taken by measuring the projected image of the specimen with a rule, obtained by projecting a stage micrometer at the same distance from the projector and tracing the image on paper. Possibly Carriker's measurements were made from a camera-lucida drawing. Vint (1939, p. 301) has shown that the difficulty, when drawing with a camera-lucida, of keeping the pencil on the outline of the object (and not just within it) may result in a very considerable error, amounting to as much as 65 per cent. in the case of red blood corpuscles, and if Carriker's measurements were made thus the discrepancy would be accounted for.

20. "*Stray Notes on Mallophaga*."—III.  
*Some Corrections.*

Owing to the great distance between writer and publisher of these notes, made more hampering by war-conditions, errors which creep in are liable to escape uncorrected.

In Part III. (Hopkins, 1941) the following small corrections should be made :—

P. 44. The type-locality of *Bovicola chorleyi* Hopk. is Patongo, *not* Potango.

P. 45, line 28. The reference should be Hopkins, 1940, p. 418.

P. 46, line 40. For "correctly" read "incorrectly."

21. *The Host of Turacœca scleroderma* (Ewing).

*Turacœca scleroderma* was originally described (Ewing, 1930, p. 127), as a *Colpocephalum*, from a single male collected on *Musophaga rossæ* in the Ituri Forest. Thompson (1938, p. 352, figs. a, c, d, e, pl. xii. figs. 1, 2) figured the species and transferred it to *Turacœca*, but as his determination was made only from the description and his material came from *Corythæola cristata*, there was room for doubt as to its correctness.

I therefore submitted one of the males used by Thompson for his figures to Dr. Ewing, with a request that he would compare it with the type. He has kindly made the required comparison, and writes "the two are found to agree in all specific details. They are undoubtedly the same."

In view of the result of the comparison of my specimen with the type, there can be no further doubt of the correctness of Thompson's determination. I have examined *Turacæca* from a very considerable number of specimens of *Corythæola cristata*, and find that all of them are *T. scleroderma*; on the other hand, the *Turacæca* from a number of specimens of *Musophaga violacea rossæ* are all *T. bedfordi* Thompson, or possibly a subspecies of this. There can therefore be no doubt that the type of *T. scleroderma* was a straggler, and that the true host is *Corythæola cristata* (Vieillot), a common bird in the Ituri Forest.

The description of *Colpocephalum subrotundum* (Giebel (1874, p. 266) agrees excellently with *Turacæca*, and it seems to me practically certain that the species belongs to this genus. Giebel gives no indication of the number of specimens from which it was described, but states that the type (or types) was found on a dry skin of *Musophaga v. violacea*. It is possible that *T. bedfordi* Thompson is a synonym of *Turacæca subrotunda* (Giebel), but it would be most unsafe to make this assumption until the type of the latter can be examined, lest *T. subrotunda*, like *T. scleroderma*, should prove to be a straggler.

## 22. *The Identity of Nirmus oculatus Rudow.*

Rudow (1870, p. 465) described a *Nirmus oculatus*, from *Bubo virginianus*, which no subsequent author appears to have made any attempt to identify; Osborn (1896, p. 219) described a *Docophorus bubonis* from the same host. Having recently received for determination some specimens of Owl-Philopteri from *B. virginianus subarcticus*, and having determined them as *Strigiphilus bubonis* (Osborn)\*, it occurred to me to look up the description of *N. oculatus*. Allowing for the vagueness of all Rudow's descriptions and for the fact that his

\* I agree with Clay and Meinertshagen in thinking that *Eustrigiphilus* cannot be maintained as a distinct genus.



figures of "Grösse" mean nothing (Hopkins, 1940, p. 418), the description fits my specimens excellently, except that the abdomen is stated to be mainly brown (evidently owing to the crop being full of feather-debris) and trabeculae are stated to be absent. With this one exception the description of the head is quite good, and fits my specimens a good deal better than most of Rudow's descriptions fit the species for which they are intended. But in *bubonis* the trabeculoid processes are very small and do not project, as in many species, but form a continuation of the general outline of the head. Given carelessness of the sort that is rightly attributed to Rudow, they could very easily be overlooked.

There is no reasonable doubt that the two descriptions refer to the same species, and *Strigiphilus bubonis* (Osborn) must in future be known as *S. oculatus* (Rudow). It would obviously be desirable to erect a neotype for *S. oculatus*, but I am unable to do this as my material is from *Bubo v. subarcticus*, whereas it is most probable that Rudow's specimens came from *B. v. virginianus*.

### 23. Some Notes on Synonymy.

In the past, far too many names have been sunk as synonyms on altogether insufficient evidence, and in particular without the author having examined material from the type-host, all discrepancies between the material under examination and the description being put down to inaccuracy on the part of the original describer. Piaget was particularly fond of accusing both Denny and Giebel of inaccuracy, no doubt often justly, but in other cases almost certainly owing to the fact that his material (from a different host) was not conspecific with theirs. The result has been endless confusion in the nomenclature, for in a number of cases the species described by Denny, Giebel, and Piaget respectively under the same name are not conspecific (in some cases not even congeneric). Nor is this all: the premature sinking of a name as a synonym has frequently been the cause of the unnecessary renaming of a species; Taschenberg's unfounded belief that *Ardeicola fissomaculata* (Giebel), of which he had not seen specimens, was the same as *A. ciconiae* (Linn.)=*A. versicolor* (Nitzsch) was the direct cause, in all probability, of Piaget's description of the

same form as *L. genitalis*; the mistake persisted many years and Harrison, as late as 1916, listed *fissomaculata* as a synonym of *ciconiæ* and *genitalis* as a good species.

There was some justification for this mode of procedure before the discovery of the systematic importance of the genitalia in Mallophaga, and while none of the important collections was in a state to allow of critical examination of the specimens\*. But even to-day we find authors sinking names as synonyms without having seen material from the type-host. It seems to the writer that one of the first requirements in the clearing up of the chaos in which the systematics of the Mallophaga wallow, is to regard difference of host as *prima facie* evidence that two insects are not conspecific, and to investigate the possibility that names referring to similar insects from the same species of host may refer to the same species of Mallophaga.

It is obvious that the ideal method is direct comparison of the types, but this is seldom possible except in the cases of species described by Denny and Piaget, both of whose collections are, for the most part, in the British Museum. The next most satisfactory method is the comparison of modern specimens with the types of both the old names. Through the kind co-operation of Miss Clay and Dr. Kéler, I was able to establish a few synonymies by this method before the war caused all types to be inaccessible, the material used for comparison being in all cases from the type-host and being compared with Denny's or Piaget's types by Miss Clay and with Nitzsch's or Giebel's types by Dr. Kéler. Since the war the only available method has been to compare material from the type-host with the descriptions and figures.

A few synonymies in the genus *Nirmus* Nitzsch *nec* Hermann are given below, the cases in which material has been compared with the actual types being indicated by an asterisk :—

*Nirmus euprepes* Kellogg and Chapman, 1902=*Quadriceps strepsilaris* (Denny), 1842.

*Nirmus gloriosus* Kellogg and Kuwana, 1902=*Quadriceps birostris* (Giebel), 1874.

\* Nitzsch's material was nearly all in alcohol, Denny's was mounted dry on cards and Piaget's was mounted in a very unsatisfactory medium.

*Nirmus ochropygos* \* Nitzsch, 1866 = *Quadriceps hæmatopi* \* (Denny), 1842.

*Degeeriella oliveri* Johnston and Harrison, 1912 = *Luniceps phæopi* (Denny), 1842.

*Nirmus opisthotomus* Kellogg, 1910 = *Quadriceps hemichrous* \* (Nitzsch), 1866.

*Nirmus subcingulatus* Nitzsch, 1866 = *Quadriceps strepsilaris* (Denny), 1842.

*Nirmus vanelli* Denny, 1842, nec Schrank 1803 = *Quadriceps hospes* (Nitzsch), 1866.

In the last-named case *vanelli* Schrank was described as a *Pediculus*, and Denny's name would be valid but for the fact that Schrank's species is also apparently a *Quadriceps*. It is strange that Giebel did not spot the identity of *vanelli* Denny and *hospes*, for the species is a most characteristic one, Denny's figure is quite good and the description of *hospes* agrees perfectly with my specimens. The reason is probably his completely erroneous statement (1874 p. 168) that Denny described the species from *Tringa cinerea*.

To sort out names which have been wrongly relegated to synonymy is even more important than to get rid of superfluous names applying to the same insect, because these erroneous synonymies cause infinite confusion. The names mentioned below have been considered synonymous, but the species are perfectly distinct if the male genitalia are examined. The basis of comparison has been material which agrees with the original description, from the type-host. In the case of several hosts being mentioned, I have assumed the first on the list to be the type-host. I have not succeeded in seeing material from *Totanus erythropus*, and have had to use material from *T. totanus* to represent *Quadriceps furvus*: it is extremely improbable that my specimens are really *furvus*.

*Quadriceps fissus* (Burmeister), from *Charadrius hiaticula*, has been considered by most authors to be the same as *Quadriceps bicuspis* (Nitzsch), from *Charadrius dubius curonicus* (= *C. minor*); they are distinct both in male genitalia and in shape of head. Harrison (1916, pp. 109, 113) sank both to *hiaticulæ* "Müller in O. Fabricius." *Pediculus hiaticulæ* Müller is a *nomen nudum*, and in my

opinion *Quadraceps hiaticulæ* (O. Fabricius) represents the very narrow species, found on *Charadrius hiaticula*, which Waterson (1915, p. 35) discussed at some length as *Nirmus* sp., without being able to find a satisfactory name for it.

Another group of *Quadraceps* in which much confusion has resulted from unjustified lumping is that found on the *Tringinae*. The earliest name for any member of this group is *Quadraceps furvus* (Burmeister), from *Totanus erythropus* (= *T. maculatus*) and several other hosts, and *Q. obscurus* (Burmeister), from *Tringa glareola* and other hosts, followed by *Q. ochropi* (Denny), on *Tringa ochropus*, *Q. similis* (Giebel), on *T. nebularius* (= *T. glottis*) and *Q. naumanni* (Giebel) on "*Totanus gilvipes*." Piaget sank all these names to *furvus*, and this name has subsequently served for the whole group except the few described since Piaget's time. I hope to publish figures of the genitalia of members of the group in the near future, meanwhile it will be sufficient to mention that, with the possible exception of *naumanni*, whose host "*T. gilvipes*" seems to be unknown to ornithologists, all the names mentioned refer to perfectly distinct species.

#### 24. *The host of Stachiella ovalis* (Bedford).

When Bedford described *S. ovalis* (1928, p. 841) he gave *Pœcilogale albinucha* as the host, but the following year (1929, p. 514) he recorded two lots of the species from *Ictonyx striatus*, and later I collected a third lot from a subspecies of *I. striatus* in Kigezi district, Uganda. In recording these latter, Bedford (1936, p. 49) remarked "In view of the fact that *T. ovalis* has been found three times on *Ictonyx striatus* and a new species on *Pœcilogale doggetti*, I feel convinced that the host from which the type-specimens of *ovalis* were collected was misidentified." The evidence with regard to the Kigezi material was not entirely satisfactory, for the two hosts were collected at the same place and time by Africans, and there was a possibility that the two species of parasites had been wrongly attributed to the two species of hosts. Further evidence was, therefore, desirable.

On a recent visit to Kigezi I collected one specimen of *Ictonyx striatus* ssp. and ten of *Pœcilogale albinucha doggetti*. I removed the parasites myself, and found

*Stachiella ugandensis* (Bedford) on every *Pacilogale* and a short series of *S. ovalis* (Bedford) on the *Ictonyx*. Bedford's belief that his original host-record for *S. ovalis* was a misidentification is, therefore, fully confirmed.

25. *A New Name for Goniodes setosus* Piaget, 1880, p. 263

*Goniodes setosus* Piaget (1880, p. 263, pl. xxi. fig. 9) is invalidated by *Goniodes minor* var. *setosa* Piaget (1880, p. 257). The former is a *Strongylocotes*, and I rename it *Strongylocotes setifer*. The type is the specimen in the British Museum selected by Clay (1940, p. 429) as lecto-type of *G. setosus*.

26. *The Identity of Goniodes rotundus* Rudow.

Clay (1941, p. 129) remarks of *Goniodes rotundus* Rudow that "It does not appear from the description that this species is conspecific with *diversus*." There is every justification for this view, yet I believe that she has not fully realised the exceptional carelessness and peculiar methods of Rudow, especially as exemplified in his 'Beitrag,' and that the opinion is incorrect.

Lacking material of any of the species concerned, I have compared Rudow's description of *rotundus* with his description of *diversus*, and both with Taschenberg's figure of *Virgula eximia* (Rudow), which Taschenberg considered to be the same as *diversus* and which must be assumed to be very similar. There are points in the description of *diversus* which make me fully share Clay's opinion that it is probably not the same as *V. eximia*.

The description of *rotundus*, like all those in the 'Beitrag,' is practically meaningless, and it consists of only 52 words. Of the very few characters given by Rudow, I have found none that are seriously at variance with his description of *diversus*, and three (the only ones which are of the slightest value) correspond closely with his description of the latter species. He states that the abdomen of *rotundus* is "fast kreisrund" and that of *diversus* is "eiförmig, Breite zur Länge wie 2 zu 2." The abdomen of *rotundus* is further stated to be "gelbgerändert mit dahinter liegender breiter brauner binde," while that of *diversus* is "Grundfarbe gelb, jedes Segment mit gelbem Randflecke, darunter eine spitzeckige nach oben gewendete

gekrümmte rothbraune Zeichnung." This might very well be an expanded and less careless version of his earlier description. In *rotundus* the abdomen of the female has at the apex "2 stumpfen, mässig grossen höckern," while the apex of the abdomen of *diversus* is "fast gerade mit rundem Ausschnitte in der Mitte," which (though it sounds so different) is merely another way of saying the same thing. Comparison of the descriptions given in 1869 and in 1870 of species which are admittedly the same will show much more serious discrepancies in many cases than are to be found in this instance.

But there is also another argument in favour of the two descriptions referring to the same insect, though one which, to the best of my belief, has not previously been employed. Of the 65 species of Mallophaga described by Rudow in the 'Beitrag,' all but 10 are described again under the same names in the two papers published in 1870, invariably without the smallest indication that they had been described previously. It seems reasonable, therefore, that we should expect to find the exceptions dealt with in one form or another, and actually the exceptions are very informative: *Nirmus acutifrons* has been transferred to *Lipeurus*; *L. alchatae* is now in *Nirmus* and includes *N. paradoxus*, for we find that *alchatae*, which in 1869 only had *Pterocles alchata* as a host, now has *Syrhaptus paradoxus* in addition, these two hosts being those recorded for *N. paradoxus* in 1869; *Nirmus quadrangularis* is absent under this name but is described as *N. bipunctatus*, the reason for the change of name being completely obscure; *Goniocotes ocellatus* has had its name altered to *G. dentatus*, again for no obvious reason; *Docophorus crassipes* is missing, doubtless because Rudow had discovered the prior use of the name by Burmeister, and I am unable to trace the specimens unless they are included in the notes on specimens from *Rhynchotus rufescens*, which Rudow discusses under *Goniocotes dilatatus* and which certainly represent the suppressed *G. rotundatus* and may perhaps represent *D. crassiceps* as well; *Lipeurus cinereus* is described as *L. nyrocae*, doubtless because of the existence of *L. cinereus* Nitzsch; *Goniodes rotundus* is the species under discussion, which I suggest has been renamed *G. diversus*. Thus of the entire 65 species only

*Lipeurus lepidotus* (and possibly *D. crassipes*) is now accounted for, and it seems reasonable to suppose that Rudow had meanwhile decided that this was not a valid species. These facts establish a very high degree of probability that, if we find a species described in the 'Beitrag' and omitted in the papers of 1870, it is to be looked for in the latter papers under a different name but with the same host-record.

From the correspondences in the descriptions and from the fact that *G. rotundus* never appears again in any of Rudow's papers, or indeed, in those of any other author before 1916 (except that Piaget, 1880, p. 284, mentions it as a synonym of *diversus*), I am completely convinced that *G. diversus* is merely an unnecessary and unacknowledged *nomen novum* for *rotundus*, that the type is the specimen in the Halle collection which had been relabelled *diversus*, and that the species must be known as *Virgula rotunda* (Rudow).

It is distasteful to criticize the work of a dead man in this destructive fashion, but a full understanding of Rudow's methods is essential to any real attempt to recognize the species which he described. Once his methods are understood, the fact that the species described in the 'Beitrag' are redescribed in 1870 is of great value, because the later descriptions are much fuller and not so careless as those in the 'Beitrag.' That his practice of redescribing species without reference to any prior description is not confined to species described in the 'Beitrag' (in which case it might be used as an argument that Rudow did not consider the 'Beitrag' to constitute a technical publication), is shown by the instance of *Acidoproctus rostratus*, which he described no less than three times (1866, p. 465, 1869, p. 46 and 1870, p. 141).

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XIII.—A Review of the Genus *Zaus* Goodsir, and a Description of Two Species of *Laophonte* Philippi (*Copepoda*, *Harpacticoida*). By A. G. NICHOLLS, University of Western Australia.

IN an account of the marine Harpacticoids from the River St. Lawrence (Nicholls, 1939) a new species of *Zaus* was described, which is now regarded as synonymous with *Z. aurelii* Poppe. In the light of further knowledge other changes in this genus are proposed.

In the same paper (p. 303) reference was made to two species of *Laophonte* which were found in the collections but not identified. Since then a revision of this genus has been made (Nicholls, 1941) and these two species, which differ from any known species, have been described briefly and included in the keys. The full descriptions and figures of these species are given below.

A list of errata in the account already referred to is also included.

*ZAUS* Goodsir, 1845.

When identifying the single specimen of this genus which occurred in the collections from Trois Pistoles, two species were overlooked: *Z. contractus* Thomson, 1883, and *Z. aurelii* Poppe, 1884. The latter has also been described and illustrated by Sars (1909) and by Willey (1923) and, having since seen these and Poppe's original description, I have little hesitation in referring both *Z. caeruleus* Campbell (1929) and *Z. intermedius* Nicholls (1939) to *Z. aurelii* Poppe.

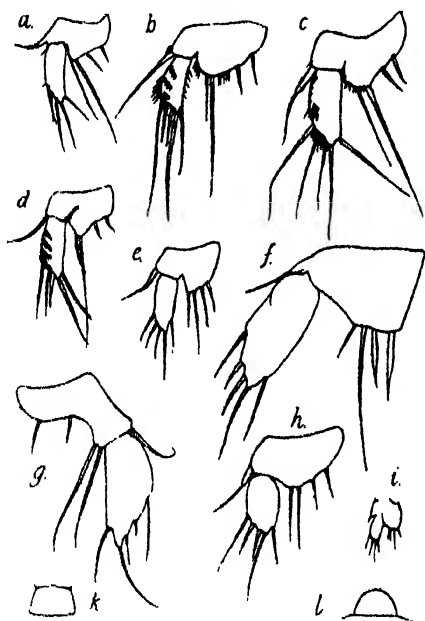
In the genus *Zaus*, apart from the segmentation of the first endopod, the shape and armature of the fifth leg



form the best distinguishing features. The specific variation in this appendage is shown in fig. 1 (*a-i*), in which drawings of the fifth legs of all the known species are reproduced for comparison.

It will be seen that while there is some variation in the shape of the distal segment of *aurelii* as shown by Poppe,

Fig. 1.



The fifth leg and rostrum in *Zaus* females.

- a*, *Z. aurelii* Poppe (after Poppe, 1884); *b*, *Z. aurelii* Poppe (after Willey, 1923); *c*, *Z. caeruleus* Campbell = *aurelii* Poppe (after Campbell, 1929); *d*, *Z. intermedius* Nicholls = *aurelii* Poppe (after Nicholls, 1939); *e*, *Z. aurelii* Sars = *sarsi*, sp. n. (after Sars, 1909); *f*, *Z. goodsiri* Brady (after Sars, 1911); *g*, *Z. abbreviatus* Sars (after Sars, 1911); *h*, *Z. spinatus* Goodsir (after Sars, 1911); *i*, *Z. contractus* Thomson (after Thomson, 1883); *k*, rostrum of *Z. aurelii* (from Nicholls, 1939 (*intermedius*)); *l*, rostrum of *Z. sarsi* (from Sars, 1909).

Willey, Campbell, and myself (fig. 1, *a-d*), they are remarkably constant in the shape and armature of the basal segment, in which feature they differ from the

other species of the genus. At the same time, the fifth leg of the species identified as *aurelii* by Sars (1909) (fig. 1, *e*) shows a striking difference in both shape and armature of the basal segment, in which it much more closely resembles that of *goodsiri* Brady (1880) (fig. 1, *f*).

It cannot, however, be identified with Brady's species, and is here regarded as a distinct species, for which the name *sarsi* is proposed. That the species identified by Sars as *aurelii* is distinct from *aurelii* Poppe is further shown by a comparison of the rostrum in each (fig. 1, *k*, *l*). Poppe (1884, pl. xx. figs. 7 & 8) showed his species with a truncate rostrum bearing two setæ. This condition was shown also by myself (1939, fig. 5, R, and reproduced here in fig. 1, *k*), whereas the rostrum in the species identified by Sars as *aurelii* (1909, pl. ii. fig. 2, and reproduced here in fig. 1, *l*) is rounded and without setæ.

A comparison of the fifth leg of *cæruleus* with that of *intermedius*, and of both with the illustration given by Willey (1923, p. 327) for *aurelii* (here shown in fig. 1, *c*, *d*. & *b*, respectively), leaves little doubt that the same species was being dealt with in each case. As pointed out by Willey (*loc. cit.*, p. 328), in this species the female fifth leg is constructed on the same plan as in *spinatus* Goodsir (fig. 1, *h*), and is quite different from those of *abbreviatus* and *goodsiri*. Sars' *aurelii*, is of the *goodsiri*-type (cf. fig. 1, *e* & *f*). That of *contractus* Thomson (fig. 1, *i*) compares most closely with the fifth leg of *goodsiri*.

The species of *Zaus* are, therefore, as follows :—

*Zaus spinatus* Goodsir.

1845. *Zaus spinatus* Goodsir.

1909. *Zaus spinatus* Sars.

1911. *Zaus spinatus* Sars.

*Distribution*.—British Isles, Norway, Arctic.

*Zaus goodsiri* Brady.

1880. *Zaus goodsiri* Brady.

1911. *Zaus goodsiri* Sars.

1932. *Zaus goodsiri* Wilson.

*Distribution*.—British Isles, Norway, Woods Hole.

*Zaus contractus* Thomson.1883. *Zaus contractus* G. M. Thomson.1895. *Zaus contractus* G. M. Thomson.*Distribution*.—New Zealand.*Zaus aurelii* Poppe.1884. *Zaus aurelii* Poppe.? 1903. *Zaus aurelii* T. Scott.nec 1909. *Zaus aurelii* Sars.1923. *Zaus aurelii* Willey.1929. *Zaus caeruleus* Campbell.1939. *Zaus intermedius* Nicholls.*Distribution*.—North Pacific, ? Finmark, Hudson Bay  
New Brunswick, Vancouver, St. Lawrence.*Zaus abbreviatus* Sars.1904. *Zaus abbreviatus* Sars (1911).*Distribution*.—Norway, Arctic.*Zaus sarsi*, sp. n.1909. *Zaus aurelii* Sars.*Distribution*.—Arctic.*Key to the Females of Zaus.*

- |   |    |                                   |
|---|----|-----------------------------------|
| 1. First endopod 2-segmented .....  | 2. |                                   |
| First endopod 3-segmented .....   | 4. |                                   |
| 2. Basal segment of fifth leg enlarged below attachment of distal segment, apical seta adjacent to distal segment, no inner expansion ..... |    | <i>abbreviatus</i> Sars, 1904.    |
| Basal segment of fifth leg with inner expansion .....   | 3. |                                   |
| 3. Basal segment of fifth leg no wider than long, inner expansion half as long as distal segment .....                                      |    | [1883. <i>contractus</i> Thomson, |
| Basal segment of fifth leg twice as wide as long, inner expansion less than one-fourth of distal segment .....                              |    | <i>spinatus</i> Goodsir, 1845.    |
| 4. Distance between two inner spines of basal segment of fifth legs less than space between second spine and long apical seta .....         |    | <i>aurelii</i> Poppe, 1884.       |
| All four appendages on basal segment of fifth leg equidistant .....   | 5. |                                   |
| 5. Distal segment of fifth leg with inner margin distinctly convex .....  |    | <i>goodsiri</i> Brady, 1880       |
| Distal segment of fifth leg with inner margin slightly concave .....  |    | <i>sarsi</i> , sp. n.,            |

## LAOPHONTE Philippi, 1840.

*Laophonte (Laophonte) laurentica* Nicholls. (Fig. 2.)Syn. *Laophonte (L.) laurentica* Nicholls, Rec. Sth. Austr. Mus. 1941, vol. vii. pt. 1.

**Occurrence.**—Two specimens, one of each sex, were washed from *Fucus* growing on rocks in front of the Marine Station at Trois Pistoles, P.Q., Canada. (Sample no. ii. of Nicholls, 1939.)

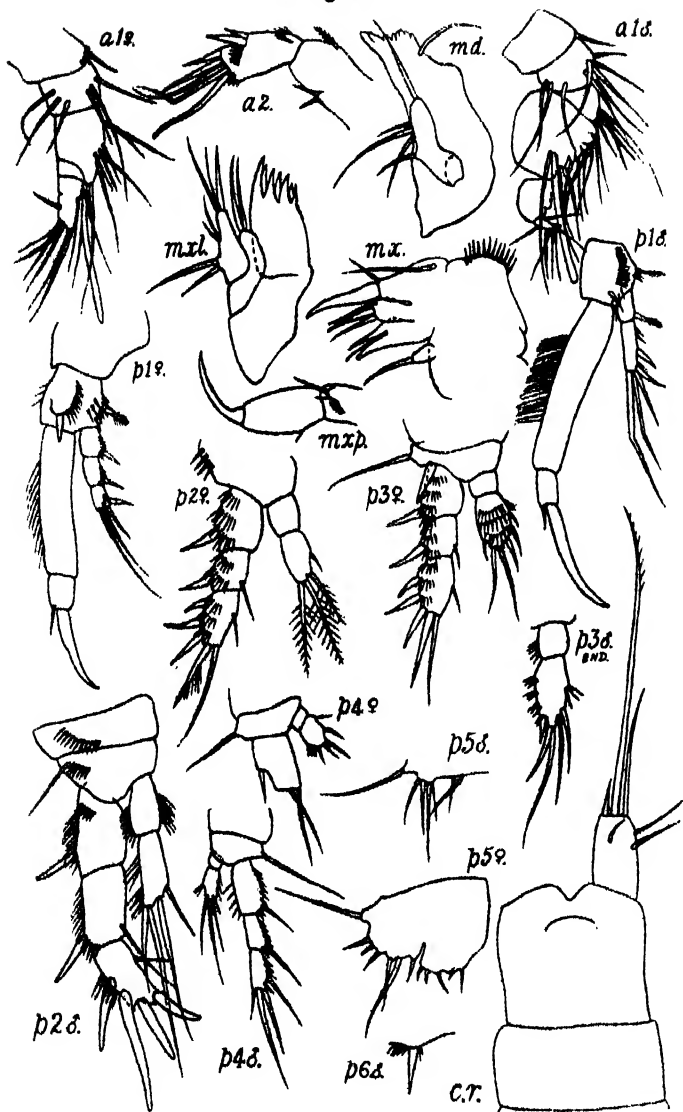
**Female.**—Length 0.73 mm. Body of usual shape in this genus, tapering from in front posteriorly and constricted between segments; urosome 4-segmented. The first antenna is 5-segmented, with only three segments in the basal portion. The end segment shows an indication of subdivision; the segments are short and compact. The second antenna has a reduced exopod bearing two small setæ. The mouth-parts are normal (fig. 2). First leg with 2-segmented endopod, the segments rather strongly built and the terminal claw accompanied by an accessory seta. The exopod is 3-segmented, with the usual setæ. Legs 2–4 with the following seta formula:—

	endopod.	exopod.
p. 2 . . . . .	0. 220	0. 1. 123
p. 3 . . . . .	0. 321	0. 1. 123
p. 4 . . . . .	0. 221	—

The fourth exopod is almost certainly malformed, since it is only 1-segmented and deficient in setæ for a normal 1-segmented exopod. The fifth legs are distinctly unusual, and, although reminiscent of the condition in *australasica* Thomson (1883), it is probable that they also are malformed. The caudal rami are half as long again as wide and little more than half the length of the anal segment.

**Male.**—Length 0.75 mm. Body similar to that of the female. First antenna 6-segmented, modified for grasping. First leg with endopod longer than in the female, the terminal claw more slender and with accessory seta; exopod 2-segmented. A similar condition in which the first exopod is 3-segmented in the female and 2-segmented in the male is found in *capillata* Wilson (1932). The

Fig. 2.



*Laophonte (Laophonte) laurentica* Nicholls (1941). Male and female. All appendages have been drawn to the same scale except for the mandible, maxillule and maxilla, which are considerably magnified.

third endopod is 2-segmented, with two inner and two terminal setæ and a spine, corresponding to the outer seta of the female. The fifth legs are reduced, as usually occurs in those species having a reduced exopod on the second antenna.

In many points this species resembles *manifera* Wilson (1932), but lacks the peculiar armature of the second and third endopods in the male of that species. In the powerful structure of the first antenna and first legs it approaches *cornuta*, but there is no trace of a spur on the first antenna.

*Laophonte arenicola* Nicholls. (Fig. 3.)

Syn. *L. arenicola* Nicholls, Rec. Sth. Austr. Mus. 1941, vol. vii, pt. i.

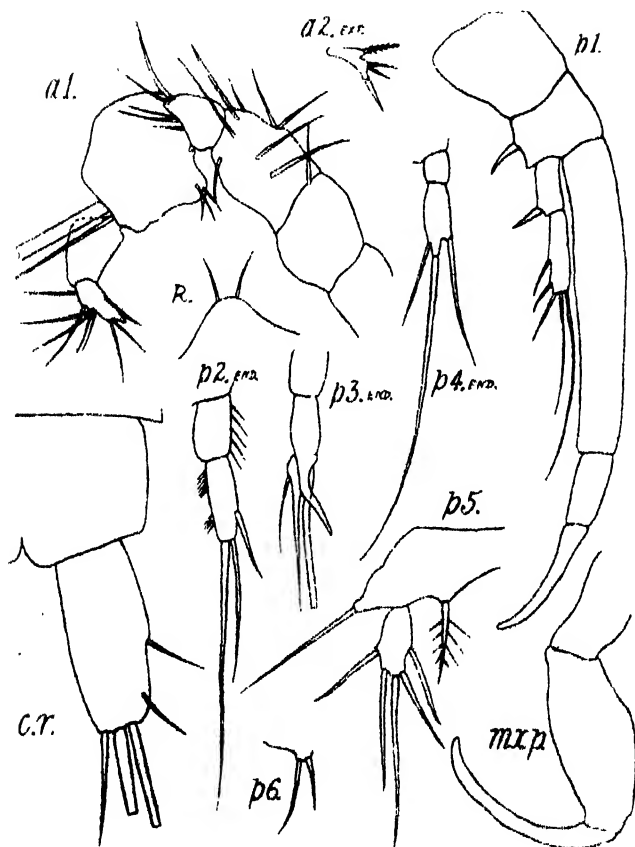
*Occurrence*.—A single specimen, a male, was washed from coarse sand at a depth of 8 metres in the St. Lawrence. (Sample no. iii. of Nicholls, 1939.)

*Male*.—Length 0.60 mm. First antenna 6-segmented, modified for grasping; second antenna with exopod well developed, with four setæ. First legs with strong endopod, the terminal claw without accessory seta; exopod 2-segmented. Third endopod 3-segmented, the basal and middle segments without setæ, end segment with three setæ, the insertion of which is not clear, but probably there are two inner and one terminal, as in *nordgaardi*. The spine on the second segment is long and somewhat curved. Seta formula for exopods 2-4 :- 0. 1. 123. The fifth legs have the distal segment distinct and well developed. Caudal rami about twice as long as wide, and longer than the anal segment.

This species, of which only the male was found, has some features in common with *nordgaardi* Sars (1908), but is closer to *huntsmani* Willey (1923). It is possible that it is identical with the latter, which has not been fully illustrated, but the fifth leg differs in having an inner spine not shown by Willey, and the basal segment is slightly expanded inside, with a well-developed seta; in *huntsmani* this expansion is suppressed. The caudal rami are more like those of *huntsmani* than of any other species of *Laophonte*, but the spine on the third endopod is much longer than in *huntsmani*. Willey's species was

taken in the estuary of the Miramichi River, in brackish water, as a planktonic form from the surface, at 10 A.M.

Fig. 3.



*Laophonte arenicola* Nicholls (1941). Male.

All the appendages have been drawn to the same scale.

It was taken again at the same place a month later by tow-net at 7 metres.

*Errata in Nicholls, 1939.*

- P. 258, line 2, for "endopod" read "exopod."  
 P. 258, line 10, for "1924" read "1934."  
 P. 259, 5th line from bottom, for "1928" read "1924."  
 P. 262, 12th line from bottom, for "(Th. & Sc.) 1903" read "Gurney 1927."  
 P. 272, 10th line from bottom, for "(Boehm)" read "(Brehm)."  
 P. 301, fig. 24, for "*ginfleurcatum*" read "*longifurcatum*."  
 P. 307, 4th line from bottom, for "1903" read "1903 b."  
 P. 311, 10th line from bottom, for "111" read "3."  
 P. 312, line 2, for "24" read "34."  
 P. 313, 5th line from bottom, for "1935" read "1939".  
 P. 314, line 21, for "3" read "21."  
 P. 315, line 20, for "78" read "48."

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XIV.—*The Fossil Acrididæ (Orth. Salt.).—Part II.*  
*Œdipodinæ* †. By FREDERICK E. ZEUNER, British  
 Museum (Natural History).

Family *Acrididæ*.

Subfamily *ŒDIPODINÆ*.

The chief diagnostic character of the subfamily is, according to Uvarov (Trans. Amer. ent. Soc. lxxvii. 1942), the presence of a discoidal vein in the medio-cubital cell of the elytron. This vein is normally part of a stridulatory organ and, therefore, raised. It rarely deteriorates but always remains recognizable. Outside the *Œdipodinæ* a discoidal vein is only found in very few groups (certain *Acridinæ*, and in the Jurassic Locustopsid *Parapleurites* Br., R. & G. (see Zeuner, Proc. R. ent. Soc. (B) xi. p. 14, 1942), but it is always less modified and not much more than an intercalated vein formed between the two rows of network-cells contained in the medio-cubital cell. It is possible, therefore, to accept the presence of a well-developed discoidal vein as an unambiguous character of the *Œdipodinæ*.

This definition of the *Œdipodinæ* has been rigorously applied to the numerous fossils which have been claimed to belong to this subfamily, with the result that only four remain. These are listed and partly re-described in the present paper. All other forms will be treated in part 4, as *Acrididæ incertæ sedis*.

In the introduction to Part I, I have mentioned that about seven fossil *Œdipodinæ* are known, owing to a less rigorous application of the above definition. There are three forms (*Œdipoda pulchra* Pongrácz, *Nanthacia torpida* Scudder and an undescribed form claimed by Scudder to be related to *Chimarocephala*) which may, but need not, be *Œdipodinæ*; they are now referred to the *Acrididæ incertæ sedis*, together with many other forms originally described under the name of "*Œdipoda*."

† Part I. Catantopina, Ann. & Mag. Nat. Hist. (11) viii. pp. 510-522, 1941.

All known fossil *Œdipodinae* come from the same locality, the lower Miocene (horizon of the Lower Mediterranean) of Radoboj in Croatia. This restriction is, of course, purely accidental.

### Genus *BRYODEMA* Fieber.

1853. *Bryodema* Fieber, *Lotos*, iii. p. 129.

1910. *Bryodema* Fieb., Kirby, *Syn. Cat. Orth.* iii. p. 260.

1930. *Bryodema* Fieb., Bey-Bienko, *Ann. Mus. zool. Acad. Sci. U.S.S.R.* 1930, p. 72.

*Genotype*.—*Œdipoda gebleri* Fischer-Waldheim, 1836  
= *Thrinchus baicalensis* Fischer-Waldheim, 1846.

*Diagnosis*.—*Œdipodinae* with only two transverse sulci cutting the carina of the pronotum, with thickened veins in the anal fan of the hind-wing. Elytra broad, with exceptionally wide discoidal area which equals the area between *CuA* and *CuP*. Discoidal vein tending to disappear. *CuA* apparently with three branches, but the first is probably *M*<sub>3</sub>. The proximal branch straight and often extending to and joining *CuP*, not reaching the margin.

*Distribution*.—Recent: Central and East Europe, Siberia, Mongolia, North China, Tibet. Miocene: Hungary.

### *Bryodema croatica* Pongrácz.

1926. *Bryodema croatica* Pongrácz, *Palæont. Zs.* viii. pp. 107, 108.  
(*Nomen nudum*.)

1928. *Bryodema croatica* Pongrácz, *Ann. Mus. nat. Hung.* xxv. pp. 132, 149, fig. 19 e.

1928. *Bryodema* sp. ? Pongrácz, *Ann. Mus. nat. Hung.* xxv. p. 134, fig. 20.

*Diagnosis*.—A *Bryodema* with elytron about 33 mm. long, with seven terminal branches of *Rs*, and with a *CuA* which is strongly curved in its distal portion.

*Distribution*.—Lower Miocene: Radoboj, Croatia.

*Holotype*.—Department of Mineralogy, Hungarian National Museum, Budapest.

*Other specimens*.—Several in the Hungarian National Museum and the Hungarian Geological Survey, tentatively referred to this species by Pongrácz. A specimen with hind wing, described by Pongrácz as *Bryodema* sp. ?, in the Hungarian National Museum. One, named *Œdipoda partschi* Heer (see part 4), in Vienna ("Staatsmuseum").

*Parts known.*—Elytra, and portions of hind wing and of body.

*Measurements of Holotype, after Pongrácz.*—Elytron, length 33 mm., width about 7–8 mm. Thorax, width 7 mm. Hind femur, length 17 mm. Body, length 34 mm. Expanse of wings about 68–70 mm.

*Description.*—The venation of the elytron is very close to that of recent species of *Bryodema*, according to Pongrácz's figure and description. It shows the characteristic wide discoidal area (between *M* and *CuA*), which is as wide as the space between *CuA* and *CuP*. *CuA* has three terminal branches in the figure. Of these, the first is probably *M*<sub>3</sub>. The distal portion of *CuA* is bent upwards, especially between the two proximal branches.

*Rs* has seven terminal branches on the figure (i. e., six branches beside the termination of the main stem), whilst, according to the author's text, there are only five. *R*, which normally is a vein close to *Sc*, is omitted altogether in the figure. The description of *R* and *Rs* is by no means clear.

Pattern of numerous irregularly distributed dots, as in *Angaracris barabensis* (Pall.).

*Remarks.*—The description and the figure indeed suggest that this fossil is a genuine *Bryodema*. Fieber's genus has recently been divided by Bey-Bienko into *Bryodema* proper and *Angaracris*, the latter having a normal, narrow discoidal area with a well-developed discoidal vein.

The fossil evidently belongs to *Bryodema* in the restricted sense, having a wide discoidal area. The pattern observed by Pongrácz is not restricted to *Angaracris barabensis* (Pall.), but occurs in *Bryodema* also, as for instance in individuals of *Bryodema tuberculatum* (Fabr.). The fossil is well characterized, however, by the large number of branches of *Rs* (seven). In recent species it rarely exceeds five.

Early workers who saw the specimens (? Unger, ? Heer) labelled them as "*Ædipoda partschi* Heer." The hind wing of the specimen described by Pongrácz as *Bryodema* sp. ? is quite unlike this genus in shape, though the described and figured portion of the venation suits it tolerably well. There are dark spots in the apex, a typical feature of *Bryodema*, and the elytron of this

specimen resembles *Bryodema croatica* Pongrácz in several respects. It is likely, therefore, that the shape of the hind wing either is badly preserved or was misinterpreted by the author. The typical thickening of the veins of the anal fan appears to be indicated in the figure. It is mentioned particularly of 1A. For these reasons I am inclined to think that this specimen cannot be separated from *Bryodema croatica*.

*Edipodinæ*, gen. indet. *nigrofasciolata* (Heer).

1849. *Edipoda nigro-fasciolata* Heer. Insektenfauna Oeningen Radoboj, ii. p. 18, pl. 2, fig. 2.  
 1852. *Edipoda nigrofasciolata* Heer, Giebel, Deutschl. Petref., p. 637.  
 1856. *Edipoda nigrofasciolata* Heer, Giebel, Fauna Vorwelt, ii. (1) p. 308.  
 1885. *Edipoda nigrofasciolata* Heer, Scudder, in Zittel, Handb. Pal. p. 768.  
 1886. *Edipoda nigrofasciolata*, Scudder, in Zittel & Barrois, Traité Pal. ii. p. 768.  
 1886. *Edipoda nigrofasciolata*, Scudder, Bull. U.S. geol. Surv. xxxi. p. 49.  
 1890. *Edipoda nigrofasciolata* Heer, Scudder, Rep. U.S. geol. Surv. Terr. xiii. pp. 220, 224. (Acridinæ, near *Scyllina* Stål.).  
 1891. 2441. *Edipoda nigro-fasciolata*, Scudder, Bull. U.S. geol. Surv. lxxi. p. 315.  
 1891. 2459. *Scyllina ? nigrofasciolata*, Scudder, Bull. U.S. geol. Surv. lxxi. p. 317.  
 1907. (*Scyllina ?*) *nigrofasciata* Heer, Handlirsch, Foss. Insekt. p. 688. (Sic !)

*Distribution*.—Lower Miocene : Radoboj, Croatia.

*Holotype*.—Not traced, possibly in the Museum of the Eidgenössische Technische Hochschule, Zürich.

*Parts known*.—Elytron.

*Measurements of Holotype, after Heer*.—Length, about 45 mm., width 6.75 mm.

*Description*.—The venation of this species, as described and figured by Heer, shows the following features : *Rs* with four terminal branches. Distal end of discoidal vein close to *M*, which it joins close to the branching point of *M*. Discoidal cell very broad, figured as being open, which is obviously incorrect. *CuA* slightly curved ; the basal portion of *CuA*<sub>1</sub> must have been long because of the great distance of *CuA* from *M*.

Apex rounded, just noticeably pointed, not truncate.

Pattern : subbasal dark patch vague. Distinct band across middle of wing (at the end of the cell). Second and

third bands more apical. Apex with dark spots. Compared by Heer with *Edaleus nigrofasciatus* (Latr.) = *Ed. decorus* (de Geer), but "crossbands more regular, nearly of equal width throughout," and "elytra darker in the apex."

*Remarks.*—The presence of the discoidal vein proves that this fossil belongs to the *Ædipodinae*. The shape of the elytron and the position of the discoidal vein are reminiscent of the Recent *Sphingonotus rubescens* (Walk.).

The specimen described by Pongrácz under this name is a different species.

\**Ædipoda* (s. l.) *radobojana*, sp. n.

1926. *Ædipoda nigrofasciolata*, Pongrácz, *Palæont. Zs.* viii. pp. 106–107.

1926. *Pardalophora nigrofasciolata*, Pongrácz, *Palæont. Zs.* viii. fig. on p. 107.

\*1928. *Ædipoda nigrofasciolata* Heer, Pongrácz, *Ann. Mus. nat. Hung.* xxv. pp. 138–139, fig. 22.

*Diagnosis.*—Only three-fifths of the size of *Æ. nigrofasciolata* Heer. Apex truncate. Discoidal vein dividing the cell, which is of normal width, into two parts of equal width. *M* with four branches.

*Distribution.*—Lower Miocene: Radoboj, Croatia.

*Holotype.*—Naturhistorisches Museum, Vienna, specimen described and figured by Pongrácz, 1928, as *Æ. nigrofasciolata*.

*Other specimens.*—According to Pongrácz, two further specimens of the same collection, one with closed wings and the left hind leg standing off (possibly no. 1843/xlix. 2), and another bearing a label "*Æ. melanosticta*." It is most regrettable that nobody bothered to mark clearly the specimens which were studied and described by Pongrácz in 1928. On my visit to the Vienna collections in 1936, I failed to identify Pongrácz's types and studied specimens in many cases.

*Parts known.*—Elytron (holotype). Other specimens, body and legs also.

*Measurements of Holotype, after Pongrácz.*—Length of elytron, 25–26 mm.

*Description.*—Elytron only three-fifths the size of that of *Æ. nigrofasciolata* Heer, comparatively broad. Fore

margin widened over the middle, as *e. g.* in Recent *Dissosteira carolina* (L.). Apex truncate. Discoidal vein dividing cell into two parts of equal width, bent downwards near its distal end and joining *M* near the junction with *CuA*. Cell not abnormally wide. *CuA* subangular at its first branching-point.

*M* is figured by Pongrácz as having five branches. The first two of these form the usual distinct fork. The following vein starts exactly opposite the end of the discoidal vein, with a curve towards the fore margin. This, and the fact that the interspaces adjoining this vein are narrower than the others, prove it to be an intercalated vein which must not be counted as a branch of *M*. The following branch, to be called *M*<sub>3</sub>, rises from the point where *CuA* touches *M*, thus closing the cell. *CuA*<sub>1</sub> carries a fork, the anterior branch of which should be a fourth branch of *M* partly fused with the true *CuA*<sub>1</sub>, since the last branch of *M* is very frequently fused with *CuA* in this manner.

The pattern consists of cross-bands, none of which reach the hind margin. Two are proximal, one lies across the end of the cell (this is the largest), and five smaller ones are found distally and in the apex.

*Remarks.*—The presence of four branches of *M* is a somewhat rare feature. In Recent *Ædipodinae*, it occurs for instance in *Gastrimargus* Sauss. and in *Pyrgodera armata* Sauss. In the latter species, and in certain *Gastrimargus*, however, both *M*<sub>3</sub> and *M*<sub>4</sub> are partly fused with *CuA*<sub>1</sub>.

The discernible features do not permit of assigning this fossil to any particular group of the *Ædipodinae*. Pongrácz already suspected that this form is specifically distinct from *Æ. nigrofasciolata* Heer and plainly stated some of the differences. The generic name *Ædipoda* is here used merely in order to comply with the Rules of Nomenclature, to make the name binomial. It indicates the relationship of the fossil in the widest sense, but it certainly is not an *Ædipoda* in the modern sense. The earlier authors like Heer were happier in this respect, since their genus *Ædipoda* comprised most of the present-day Acrididæ.

\* *Edipodinæ*, gen. indet. *kittli* (Handlirsch).H 1907. *Gryllacris* (n. l.) *kittli* Handlirsch, Foss. Inskt. p. 684.1928. *Gryllacris kittli* Handlirsch, Pongrácz, Ann. Mus. nat. Hung. pp. 126-127, fig. 16.1932. "*Gryllacris*" *kittli* Handlirsch, Karny, Jb. geol. Bundesanst. Wien, lxxxii. pp. 68-69, fig. 2.*Distribution*.—Lower Miocene: Radoboj, Croatia.*Holotype*.—Naturhistorisches Museum. Vienna.*Parts known*.—Elytra, parts of thorax and of abdomen.*Measurements of Holotype*.—Elytron, length 29 mm., width about 7 mm.; expanse of wings 64 mm.; abdomen, width 7.5 mm.*Description*.—Elytron comparatively broad. Fore margin widened near the base, and again about the middle. Apical portion of hind margin not preserved, the original shape of the apex not recognizable. Discoidal cell closed, discoidal vein closer to *M* than to *CuA*. For reference. Karny's figure should be used, since Pongrácz's figure is quite worthless.*Remarks*.—Of the four entomologists who have examined the specimen. Handlirsch and Pongrácz have considered it as a Gryllacridid, obviously under the influence of the general outline of the wing as preserved. Owing to the destruction of the apical portion of the hind margin, the elytron looks pointed, but a close examination reveals the damage. Pongrácz has tried hard to adapt the venation to this misconception of the Gryllacridid nature of this fossil. Karny and myself re-examined the specimen and recognized independently the Acridid affinities of "*Gryllacris*" *kittli*. Karny published this view in 1932, together with a fairly accurate figure.The following reasons compel one to regard this fossil as an Acridid, and not as a Gryllacridid: (1) The membrane of the elytra is thick, (2) there is a closed discoidal cell of the Acridid type, (3) this cell contains a discoidal vein, and (4) there is a straight, narrow clavus-fold between *CuP* and *1A*, as in all Acrididæ.The presence of the discoidal vein assigns the fossil to the *Edipodinæ*, among which it even may one day prove to be conspecific with one of the other named species of similar size.

XV.—A Revision of the Genus *Ornithacris* Uvarov, 1924 (*Orthoptera*, *Acrididae*). By B. P. UVAROV, D.Sc., British Museum (Natural History).

ORNITHACRIS Uvarov, 1924.

1923. *Glaphyra* Uvarov, Ann. & Mag. Nat. Hist. ser. 9, vol. xi. p. 144 (pre-occupied name).

1924. *Ornithacris*, Uvarov, l. c. vol. xiii. p. 9.

The view, held by me in 1924, that there is only one species of this genus, but that it is divided into several very distinct subspecies, continues to hold good, although the number of recognizable subspecies has now increased.

*Ornithacris cyanea* (Stoll, 1813).

1813. *Gryllus locusta cyaneus* Stoll, Represent. Spectr. Mant. p. 31, pl. xv. c, fig. 56.

1924. *Ornithacris cyanea* Uvarov, l. c. p. 9.

Of the five subspecies recognised in my revision, one (*cyanea*) has been re-diagnosed and divided by Miller (1929) into two, *cyanea* and *orientalis*. In my treatment of subsp. *pictula* (l. c. p. 12), I have already pointed out that the Transvaal specimens differ from those of the Cape Colony by their coloration and by larger size, and a study of more extensive series before me now convinces me that *pictula*, as understood by me before, must be divided into two subspecies, the South African subsp. *pictula* and the East-African subsp. *rosea*, n.

Thus the total number of subspecies recognised now is seven, and the following practical key maybe used for their determination. It must be realised, however, that we still do not know enough of the subspecies to be found in many parts of Angola, Belgian Congo, Portuguese East Africa, nor are the West-African forms sufficiently well known. When using the key it must also be remembered that transitional forms between subspecies should be expected to occur.

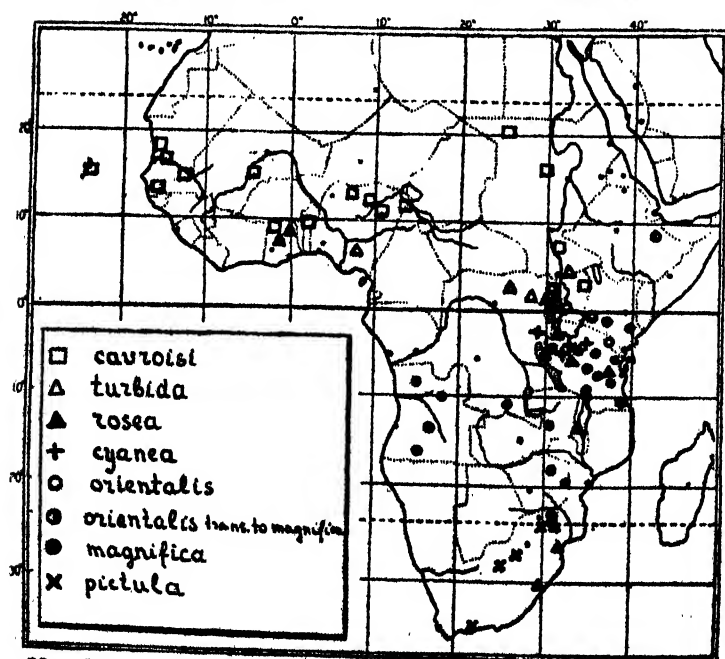
The known distribution of the subspecies is shown on the appended map.

Key to Subspecies of *Ornithacris cyanea* (Stoll).

- 1 (6). Median pronotal keel strongly raised, very convex in profile, its crest smooth. Hind angle of pronotum strongly pointed.
- 2 (5). Sides of pronotum uniformly dark, with only a narrow pale anterior and lower margin. Elytra with narrow light fasciae,



- |   |                             |
|---|-----------------------------|
| 3 (4). Hind wings violaceous .....  | 3. <i>orientalis</i> .      |
| 4 (8). Hind wings light red to rose .....   | 2. <i>magnifica</i> .       |
| 5 (2). Sides of pronotum with a pale longitudinal fascia widened behind. Elytra with broad light fasciae. Wings light cinnabar-red .....  | 1. <i>pictula</i> .         |
| 6 (1). Median pronotal keel moderately or scarcely raised, punctured. Hind angle of pronotum rounded at the apex.   |                             |
| 7 (12). Median pronotal keel thick, distinctly raised, weakly convex in profile.  |                             |
| 8 (9). Sides of pronotum uniformly dark, with only the lower and lower part of the anterior margin pale. Elytra with narrow light fasciae. Wings distinctly infumate, dirty red basally .....                                   | 6. <i>turbida</i> .         |
| 9 (8). Sides of pronotum with a pale longitudinal fascia widened behind. Elytra with broad light fasciae.   |                             |
| 10 (11). Wings bright rose .....  | 5. <i>rosea</i> , subsp. n. |
| 11 (10). Wings violaceous .....   | 4. <i>cyanea</i> .          |
| 12 (7). Median pronotal keel depressed, with a fine median raised line. Sides of pronotum with the longitudinal pale fascia broad, but imperfectly defined. Elytra with broad light fasciae. Wings very pale cinnabar-red ..... | 7. <i>cavroisi</i> .        |



Map showing the distribution of the subspecies of *Ornithocoris cyanea*.

*Annotated List of Subspecies.*

1. *O. cyanea pictula* (Walker, 1870).

1870. *Cyrtacanthacris pictula* Walker, Cat. Derm. Salt. Brit. Mus. iii. p. 562.

1924. *Ornithaoris cyanea pictula* Uvarov, l. c. pp. 10, 12 (partly : not the figures!).

As indicated above, I find it necessary to restrict the name *pictula* to the small subspecies, with highly-crested and brightly-patterned pronotum and with cinnabar-red hind wings. This subspecies is known to me from Knysna in the Cape Province (*type locality*), and from the following localities in the interior of South Africa : Orange River Colony ; Barberton, Bronkhorstspuit and Kliprieviersberg (15 miles S. of Johannesburg) in Transvaal. The records from three localities in Natal given in my revision (l. c. p. 13) should be referred to subsp. *rosea* (see below).

Two specimens from Cohemba, Bihé district of Angola, might be referred to this subspecies, but they are larger in size, with the light fasciæ of elytra very narrow, and the light border of pronotal lobes also narrow. Should these characters prove to be constant in a series, a distinct subspecies may have to be recognized, but in the meantime the Angola specimens must remain without sub-specific determination.

2. *O. cyanea magnifica* (I. Bolivar, 1881).

1881. *Acridium magniflour* I. Bolivar, Jorn. Acad. Sci. Lisboa, viii. p. 113.

1924. *Ornithaoris cyanea magnifica* Uvarov, l. c. p. 12, fig. 9 A.

This is the largest known subspecies, recognizable by strongly-arched pronotal crest, uniform dark coloration of pronotal sides and light red colour of hind wings. The latter may become somewhat rose-coloured, which is regarded as transition to the subsp. *orientalis* with violaceous wings.

ANGOLA : Humbe ; Duque de Braganza (both records by I. Bolivar ; the second is selected here as the *typical locality*) ; Cohemba, Bihé district (*Burr*) ; Kwangu ; Rio Mbale ; Mukoti (*Swiss Expedition*). BELGIAN CONGO : Kipiri ; Sakania. NORTHERN RHODESIA : Serenje ; Chitambo. SOUTHERN RHODESIA : Mashonaland ; Umtali.

N. TRANSVAAL : Leydsdorp. TANGANYIKA TERRITORY : Tukuyu ; Tendaguru ; Kilosa ; Tubugwe, Dodoma district ; Mkalama ; Matundu River, Kagulu, Kigoma district ; Uluguru Mts.

The specimens from the following localities have rose-coloured wings and are regarded as transitional to subsp. *orientalis*.

TANGANYIKA TERRITORY : Amani ; Masilewato, Mgori, 25 miles E. of Singida. KENYA : Chyulu hills : Nairobi.

### 3. *O. cyanea orientalis* (Sjöstedt, 1909).

1909. *Aoridium magnificum* var. *orientalis* Sjöstedt, Wiss. Ergebn. Kilim.-Meru Exped., Acrid. pp. 183, 186.

1924. *Ornithacris cyanea cyanea* Uvarov (*nec* Stoll !), l. c. p. 10, fig. 9 v.

1929. *Ornithacris cyanea orientalis* Miller, Trans. Ent. Soc. London, p. 84.

This subspecies, confused by me with the true *cyanea* of Stoll, has been re-established by Miller as a result of an examination of a photograph of the *cyanea* type. It is practically identical structurally with subsp. *magnifica*, differing only in the violaceous coloration of hind wings. In its distribution it appears restricted to Kilimanjaro and the country round the lakes Victoria and Albert, as well as to eastern Abyssinia.

KENYA : Kilimanjaro. 4500-5000 ft. (Sjöstedt ; *type locality*) ; Solai, Nakuru. UGANDA : Entebbe ; Banda, Chagwe ; Wasa, Toro ; Kepeka. BELGIAN CONGO : Mahagi port (lake Albert). ABYSSINIA : Harrar (*I. Bolivar*, 1922).

My previous record from Haut Sanga, French Congo, requires checking ; it probably applies to a somewhat similar, but smaller and darker race known to me from Cameroons and left without subspecific designation.

### 4. *O. cyanea cyanea* (Stoll, 1813).

1813. *Gryllus locusta cyaneus* Stoll, Represent. Spectr. Mant. p. 31, pl. xv. b, fig. 56.

1929. *Ornithacris cyanea cyanea* Miller, Trans. Ent. Soc. London, 1929, p. 84, pl. v. fig. 3 ; pl. ix. fig. 38.

The identity of this subspecies has been established by Miller by comparison with a photograph of the type which is in the Leiden Museum.

This and the following two subspecies differ from those already mentioned by the distinctly lower crest of the pronotum and by the rounded tip of the hind angle of the latter. In the pronotal pattern subsp. *cyanea* is very similar to subsp. *pictula*, and the colour of its hind wings is a deeper violet than in subsp. *orientalis*. It is known to me from the following localities:—

BELGIAN CONGO: N'Gwese, Lake Kivu. UGANDA: Lubale to Lwentobo, Ankole prov., 4860 ft. TANGANYIKA TERRITORY: Kalula; Mkalama; Old Shinyanga: Matalalele, Singida; Itimbya, 30 km. N. of Kahama.

5. *O. cyanea rosea*, subsp. n.

1924. *Ornithacris cyanea pictula* Uvarov (nec Walker!), *l. c.* p. 12 (partim!), fig. 9 B.

1929. *Ornithacris cyanea pictula* Miller, Trans. Ent. Soc. London, 1929, p. 84.

In the pronotal pattern this subspecies is very similar to subsp. *pictula*, but it is larger in size, has a low crest of pronotum, with the hind angle rounded at the tip, and the colour of hind wings is not light cinnabar-red, but bright rose. The measurements are given in the following table side by side with those for subsp. *pictula*:—

	<i>pictula</i> .		<i>rosea</i> .	
	♂	♀	♂	♀
Total length .....	46	63	60	75
Pronotum .....	11	15	14	17
Elytron .....	41	59	58	74
Hind femur .....	22	33	32	41

NATAL: Durban, 1 ♀; Natal, 1 ♂; Port Natal, 1 ♂, 1 ♀. TRANSVAAL: Zoutpansberg, 1 ♀; Barberton, 1 ♀. BECHUANALAND: No exact locality, 1 ♂. PORTUGUESE EAST AFRICA: Delagoa Bay, 1 ♂. TANGANYIKA TERRITORY: Bukoba, 1 ♂, 2 ♀♀ (*N. C. E. Miller*); Morogoro, 1 ♂ (*N. C. E. Miller*); Morogoro, 2 ♂♂ (including the type), 1 ♀ (*E. Burt*); Kigoma, 1 ♀; Manda, 2 ♂♂, Tindiga, 2 ♂♂, 2 ♀♀; Chilangali, 1 ♀ (all *N. C. E. Miller*). NYASALAND: Kota Kota, 1 ♀.

One male in the British Museum, labelled simply "Congo," has the hind wings purple, approaching in this respect subsp. *cyanea*.

6. *O. cyaneu turbida* (Walker, 1870).

1870. *Cyrtacanthacris turbida* Walker, Cat. Derm. Salt. Brit. Mus. iii. p. 556.

1870. *Cyrtacanthacris inclyta* Walker, l. c. p. 558.

1924. *Ornithacris cyanea turbida* Uvarov, l. c. p. 13.

The pronotal crest in this subspecies is more depressed than in *rosea* and *cyanea*, and the sides of pronotum are without the upper longitudinal light stripe. Light fasciæ on the elytra are narrower than their dark interspaces. Wings are strongly infumate, with the basal part light reddish.

GOLD COAST: Fantee (*type locality*); Tapi and Sarkwalla, Northern Territories; Buave. SOUTHERN NIGERIA: No exact locality. BELGIAN CONGO: Aru; Foradje, Haut Huri; Kasengvi and Mahagi Port, Lake Albert. UGANDA: Butiaba; Kalisizo, Buddu; Lango, Aduku. SOUTHERN SUDAN: Liria. Torit road.

7. *O. cyanea cavroisi* (Finot, 1907).

1907. *Acridium cavroisi* Finot, Ann. Soc. Ent. Fr. lxiv. p. 272.

1908. *Acridium cyaneum* var. *tereticolle* I. Bolivar, Mem. Soc. Ent. Belg. xvi. p. 110.

1924. *Ornithacris cyanea cavroisi* Uvarov, l. c. p. 13, fig. 9 n.

The structure of pronotum in this subspecies is so distinct that it might be considered a specific character. However, transitional forms to subsp. *turbida* are not infrequent, and there is no doubt that *cavroisi* is only another subspecies occurring in the most northern parts of the area of the whole species.

CAPE VERDE ISLANDS: St. Vincent. SENEGAL: Dakar; St. Louis (*type locality*). GAMBIA: No exact locality. PORTUGUESE GUINEA: Calikis (*type locality* of *tereticolle* Bol.). GOLD COAST: Yapi, Sarkwalla and Bibianaha, Northern Territories; Ashanti; Togoland. FRENCH SUDAN: Macina and Diafarabe, Middle Niger. NIGERIA: Azare; Sherifuri; Zungeru; Gadau; Lake Chad. ANGLO-EGYPTIAN SUDAN: Libyan desert in N.W. Kordofan; Um-Darag, Kordofan; Bor, Upper Nile. UGANDA: Karamoja, between Moroto and Kadawe.

# THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 51. MARCH 1942.

XVI.—*A Revision of the Cerylonini of Borneo (Coleoptera, Colydiidæ).* By H. E. HINTON, Ph.D., Department of Entomology, British Museum (Natural History).

UNTIL now not a single species of the tribe Cerylonini has been recorded from Borneo. The material dealt with here, which is all that I have been able to find in the British Museum, consists of only twenty-one specimens. of which all but two were collected by G. E. Bryant. A list of these is as follows :—

1.	<i>Gyrelon mila</i> , gen. et sp. n. ....	1
2.	<i>Pseudocerylon resa</i> , sp. n. ....	1
3.	<i>Coccilon charon</i> , gen. et sp. n. ....	1
4.	<i>Philothermus turissa</i> , sp. n. ....	1
5.	„ <i>fallax</i> , sp. n. ....	1
6.	<i>Cerylon quadricolle</i> Sharp .....	2
7.	„ <i>bryanti</i> , sp. n. ....	1
8.	„ <i>torosum borneensis</i> , subsp. n. ....	3
9.	„ <i>variolosa</i> , sp. n. ....	2
10.	„ <i>frontale</i> , sp. n. ....	1
11.	„ <i>suilla</i> , sp. n. ....	7

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Total number of specimens examined. . . 21

The fact that so many of the species are represented by uniques is a clear indication that many times this number will be discovered eventually in Borneo.

While engaged on this work, the necessity for a key to the genera of the tribe Cerylonini became apparent, and during the construction of this key it was found necessary to relegate two genera to synonymy, and transfer two genera from the Murmidiinae (Murmidiidae, *auct.*) to the Cerylonini.

The illustrations were drawn by me with the aid of a camera lucida, and lines next to figures refer to a length of 0.20 mm. unless otherwise indicated.

### *Key to the Genera of Cerylonini.*

1. Hypomera on each side with a deep, sharply-defined antennal groove which opens into a large and deep cavity for the reception of the antennal club. . . . . 2.  
     Hypomera with or without an antennal groove, but never with a cavity for the reception of the antennal club . . . . . 4.
2. Antenna 9-segmented, with a 1-segmented club (when cleared and mounted in balsam the antennal club is seen to consist of two very closely united segments). Hypomera with cavity for reception of antennal club extending to hind margin. Pronotum with a very deep transverse impression on apical half. Scutellum not externally visible. Seychelles, Africa . . . . .  
     Antenna (fig. 6) 8-segmented, with a 1-segmented club. Hypomera with cavity for reception of antennal club median or apical, not extending to hind margin. Pronotum without a transverse impression. Scutellum large, distinct, and on same plane as elytral disk . . . . . 3.
3. Hypomera with cavity for reception of antennal club not extending to anterior margin. Pronotum on each side with two very deep impressions which are only separated from antennal cavity beneath by a thin and more or less transparent membrane. Elytra with alternate intervals carinate. Japan, East Indies, Seychelles..  
     Hypomera with cavity for reception of antennal club extending to dorsal anterior margin. Pronotum without depressions. Elytra with all intervals flat. Cosmopolitan . . . . .  
     *Axiocerylon* Grouvelle [(1918).  
     *Thyroderus* Sharp [(1885).  
     *Lapethus* Casey (1890).  
     *Gyrolon*, gen. nov.
4. Hypomera with distinct caudally-diverging antennal grooves. Borneo . . . . . 5.  
     Hypomera without antennal grooves. . . . .

5. Scutellum very small, triangular. (Antennæ 10-segmented; club 1-segmented. Labrum with anterior margin emarginate or nearly truncate, not strongly produced. Anterior coxal cavities closed behind.) Sumatra, Borneo ..... [vella (1897).  
*Pseudocerylon* Grou-  
6.  
6. Antennal club 3-segmented ..... 7.  
Antennal club 1- or 2-segmented ..... 8.  
7. Labrum strongly produced, longer than broad. Pronotum with a median sulcus and with sublateral carinæ. Elytra with alternate intervals strongly carinate. Brazil ..... [(1845).  
*Gylptolopus* Erichson  
Labrum not produced, short and transverse. Pronotum evenly convex, without sulci or carinæ. Elytra with all intervals flat. Borneo ..... *Oocilon*, gen. nov.  
8. Labrum (fig. 7) strongly produced and pointed, much longer than broad. Maxillary palpi (fig. 8) with second segment as long or longer than first. Prosternum strongly and longitudinally raised, more or less carinate. Oriental Region, Madagascar, Guadeloupe ..... [(1885).  
*Cautomus* Sharp  
Labrum (fig. 15) short and transverse, rarely feebly produced. Maxillary palpi (fig. 19) with second segment distinctly shorter than first. Prosternum not longitudinally carinate, though sometimes nearly so ... 9.  
9. Antennæ 11-segmented; club 2-segmented. Tarsi 4-segmented. Cosmopolitan ..... [(1843).  
*Philothermus* Aube  
Antennæ 10-segmented; club 1-segmented. Tarsi 3- or 4-segmented. Cosmopolitan.. [(1802).  
*Cerylon* Latrelle

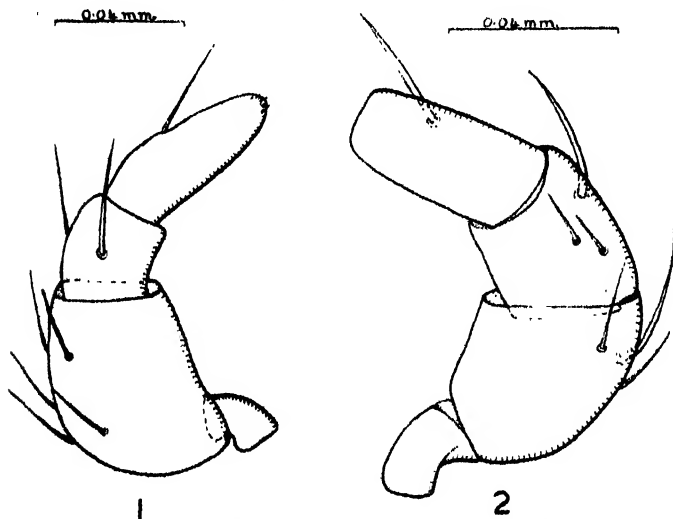
*Metacerylon* Grouvelle (1906) and *Tyrtæus* Champion (1913) have not been included in the Cerylonini, as the last segment of the maxillary palpi in both is nearly as stout as the preceding. These two genera appear to be more naturally placed in the Bothriderini.

On account of the structure of the maxillary palpi, I have removed *Lapethus* Casey (=tribe Lapethini) and *Thyroderus* Sharp (of the tribe Mychocerini) from the subfamily Murmidiinæ to the tribe Cerylonini in the subfamily Ceryloninæ. This procedure may appear on first sight somewhat arbitrary, particularly in view of the close similarity in form and general structure that exists between *Lapethus* and *Murmidius*. But looking at the matter a little more closely, it is evident that, except for the possession of antennal cavities, such genera as *Lapethus* and *Thyroderus* are at least equally close to *Cerylon* and



other typical Cerylonini. Furthermore, both *Lapethus* and *Thyroderus* possess the peculiar maxillary palpi of the Cerylonini, which are very different from those of the Murmidiinæ, as may be seen by comparing figs. 1 & 2 with figs. 3, 5, 8, & 19. Whether *Lapethus*, *Thyroderus*, and *Axiocerylon* are assigned to the Cerylonini or to the Murmidiinæ chiefly depends, in the absence of evidence which will one day be supplied by a study of the immature stages, on whether more importance is attached to the presence or absence of antennal cavities or to a similarity

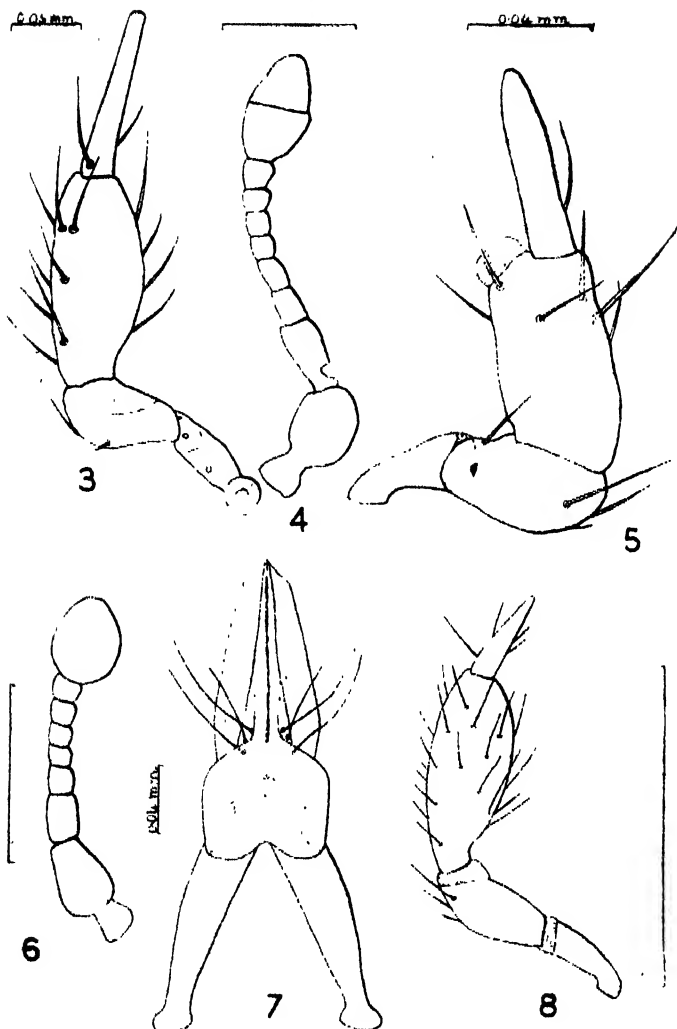
Figs. 1 &amp; 2.



1. Ventral view of maxillary palp of *Mychocerus striatus* Champ.
2. Same of *Murmidius ovalis* (Beck.).

in the structure of the maxillary palpi. The greatly enlarged third segment and the narrow pointed terminal segment of the maxillary palpi are constant features in all genera of the Cerylonini, genera which in other respects vary enormously. On the other hand, in those genera possessing antennal cavities two different types of maxillary palpi are found, the depth and position of the cavities themselves vary very much, and in one case, *Gyrelon*, an intermediate condition is found—antennal grooves

Figs. 3-8.



3. Ventral view of maxillary palp of *Axiocerylon cavicolle* Grouv. 4. Antenna of same. Second segment more extruded than is normal. 5. Ventral view of maxillary palp of *Thyroderus poratus* Sharp. Membranous appendage of apex of second segment may be an artifact. 6. Antenna of same. 7. Dorsal view of labrum of *Oostomus histrioides* Sharp. 8. Ventral view of maxillary palp of same.

on the hypomera, but no cavities for the reception of the antennal club. *Gyrelon* is in all important particulars similar to *Cerylon*, differing from the latter only in possessing antennal grooves on the hypomera. To assign *Gyrelon* to one subfamily and *Cerylon* to a different one would be absurd from the point of view of building a natural classification.

The present arrangement leaves *Murmidius*, *Mychocerus*, and allied genera in the subfamily Murmidiinae\*. Taking into account only the structure of the adults, it would appear reasonable to regard these genera as constituting a tribe in the Ceryloninae. But the structure of the only two larvæ of these groups so far known, *Murmidius* and *Cerylon*, would appear to forbid this course. The difference between the larva of *Cerylon* and *Murmidius* is of a degree usually found only between two different families.

#### GYRELON, gen. nov.

Body broadly oval. Dorsal surface and legs moderately sparsely clothed with fine, erect setæ. Head with a deep and distinct antennal groove below each eye. Eyes large and strongly convex, with their greatest diameter vertical. Antenna (fig. 9) 10-segmented; club 1-segmented; basal segment completely exposed from above. Labrum (fig. 10) with exposed part transverse, emarginate on middle anterior margin, and surface with a few long setæ. Mandible with two acute apical teeth, the dorsal of these being distinctly shorter; prostheca large and membranous. Maxilla with palp 4-segmented; second segment distinctly broader but only about half as long as first, third slightly longer and three times as broad as first, and terminal segment about half as long as third and only about one-third as broad; galea broad, about twice as long (excluding apical fringe) as broad; lacinia rather narrow, about five times as long as broad, and with a prominent, narrow, curved process extending forwards from base. Labium with postmentum undivided; palp 3-segmented, the second segment being

\* In speaking of the Murmidiinae I am referring only to the closely-related genera *Murmidius* and *Mychocerus*, both of which I have been able to examine. Included in this subfamily (or family) are a number of genera of as yet obscure relationships.

longer and about four times as broad as first or third. *Pronotum* shallowly and broadly impressed on each side and base, with middle prominently rounded and produced caudally. *Elytra* striate and punctate; intervals flat or feebly convex. Scutellum with externally visible part large, subovate, and more or less on same plane as elytral disk. *Prosternum* (fig. 12) with deep, well-developed antennal grooves between hypomera and sternum; part anterior to coxæ longer than greatest breadth of a coxa; anterior margin shallowly, arcuately emarginate for its entire breadth; process extending well beyond coxal cavities, at apex with a small median gibbosity, and on each side with a larger gibbosity which is on a lower plane; anterior coxal cavities completely closed behind by hypomera. Mesonotum with a large, median, caudal gibbosity which is directed forwards and is on same plane as metasternal disk; anterior two-thirds of mesosternum very strongly depressed. Metasternum with median longitudinal line confined to about caudal tenth. *Abdomen* with median anterior process very broad and very shallowly, arcuately emarginate for its entire breadth; second sternite less than half as long as first and sternites two to five subequal in length. *Legs* with external part of front and middle coxæ round and only slightly projecting; front coxæ nearly as broadly separated as middle; hind coxæ about half again as broadly separated as middle. *Tarsi* (fig. 11) 4-segmented; basal segment longer than combined length of two following.

*Genotype.* *Gyrelon mila*, sp. n.

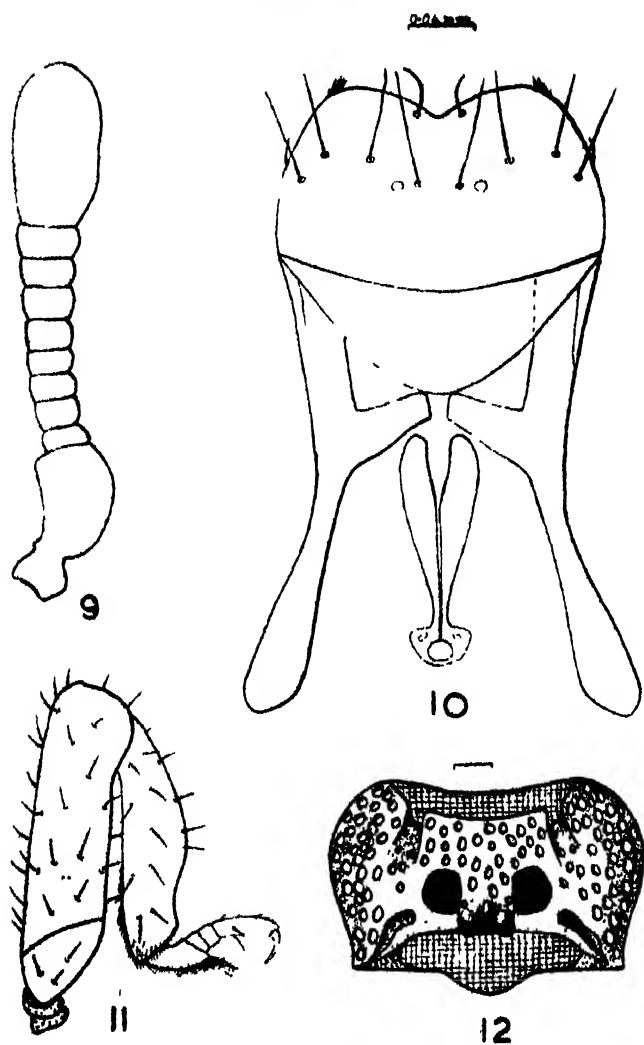
*Comparative Notes.* *Gyrelon* is very similar to *Cerylon*, but differs in having well-developed antennal grooves on the hypomera. Also no species of *Cerylon* is yet known with a comparable prosternal process or mesosternal disk.

*Gyrelon mila*, sp. n. (Figs. 9-12.)

Length 3.2 mm.; breadth 1.7 mm.

Body broadly oval; dorsal surface and legs rather sparsely clothed with fine, erect testaceous setæ, which are slightly shorter to slightly longer than scutellum. Cuticle shining and dark reddish brown. *Head* with oval to more or less irregularly shaped shallow punctures, which vary in breadth from 0.05 to 0.11 mm., and are

Figs. 9-12.

*Gyrolon mila*, sp. n.

9. Antenna. 10. Dorsal view of labrum. 11. Anterior view of front leg. 12. Ventral view of prothorax.

separated by one-fourth of one to, on middle of front, nearly one diameter; surface between punctures nearly smooth. Antenna (fig. 9) with club very large, obovate, and twice as long as broad; segments two to nine subequal in length. *Pronotum* across broadest point, which is at apical two-fifths, much broader than long (1.47 mm.: 0.93 mm.), and base broader than apex (1.31 mm.: 0.82 mm.). Sides extremely finely margined and moderately strongly arcuate, but before base broadly and shallowly sinuate; anterior margin feebly, arcuately emarginate for its entire breadth; base truncate on each side of caudally produced and rounded middle part. Disk moderately strongly convex; base with a short, nearly flat belt; on each side with a very broad, moderately shallow depression extending from base nearly to anterior margin. Surface punctate like head. *Elytra* more than twice as long as pronotum (2.13 mm.: 0.93 mm.), from base becoming broader posteriorly to broadest point, which is at basal fourth, and from basal fourth rather evenly narrowed to apex. Humeri feebly and broadly gibbous. Each elytron with eight rows of punctures, each being in a feebly (on disk) to moderately strongly (at sides) impressed stria; first parallel to suture and ending immediately behind sides of scutellum; first three rows more or less parallel and extending from near apex to near base; fourth and fifth converging near apex and ending on about apical fifth; sixth ending just behind middle; seventh extending from near base to near apex, where it ends opposite second; eighth confined to basal half of elytron. Strial punctures of disk round to oval, moderately deep, one-third (near base) to one-sixth (on middle) as broad as intervals, and separated longitudinally by usually one diameter; towards sides on basal half these punctures become much deeper, larger and denser, so that those of sixth, seventh, and eighth rows are as broad as their respective intervals. Discal intervals feebly convex to flat. *Prosternum* slightly more finely and sparsely punctate than head. *Hypomera* as coarsely and densely punctate as sides of head. *Metasternal* disk evenly, feebly convex, and with a few round punctures which are much smaller than those of *prosternum*; surface between these punctures strongly shining and minutely, scarcely noticeably alutaceous;

side with a group of coarse punctures near middle coxa, and another group of about ten near hind coxa. *Abdomen* without striae on first sternite. First sternite with a few coarse punctures (similar to those of metasternum) on middle, and sternites 1, 2, 3 and 4 each with a complete transverse row of moderately close punctures. Fifth sternite with a moderately deep impression occupying all of its disk; surface of depression with round punctures about two-thirds as coarse as those of other sternites, and separated by less than one to one diameter.

*Type*. In the collection of the British Museum (Nat. Hist.). Borneo: W. Sarawak, Quop, iii.-iv. 1914 (*G. E. Bryant*).

*Pseudocerylon resa*, sp. n.

Length 2.3 mm.; breadth 1.53 mm.

Body broadly oblong-oval and very strongly convex. Dorsal surface glabrous; ventral surface sparsely clothed with fine, very short, erect, testaceous hairs. Cuticle strongly shining and dark red or rufo-piceous, with head and pronotum distinctly darker than remainder of body. *Head* with round moderately shallow punctures, which are as coarse to one-fourth coarser than facets of eyes, and are usually separated by one to two diameters; surface between punctures smooth or with a few scarcely visible ( $\times 75$ ) microscopic punctures. Antenna with second segment slightly longer and broader than third; segments 4-9 transverse and becoming progressively larger distally; club very broadly oval, nearly round, and dorso-ventrally depressed. Clypeus with anterior margin truncate; surface more sparsely and much more finely punctate than head and also distinctly, but minutely alutaceous between punctures. Labrum with exposed part short, transverse, and with anterior margin arcuately emarginate at middle. *Pronotum* across broadest point, which is just before base, nearly twice as broad as long (1.31 mm.: 0.74 mm.) and base broader than apex (1.26 mm.: 0.74 mm.). Sides feebly arcuate, nearly straight behind middle, and finely margined; apex deeply, arcuately emarginate for its entire breadth, and with marginal line present only on lateral fourth; base very broadly, moderately deeply sinuate on each side and strongly, narrowly produced in front of scutellum. Surface with a scarcely noticeable,

longitudinal sublateral depression; disk with punctures similar to those of head, but usually separated by two to three diameters, the surface between them being smooth; sublateral region with a number of denser and much coarser punctures; extreme sides only microscopically punctate. *Elytra* more than twice as long as pronotum (1.73 mm. : 0.74 mm.), base slightly but distinctly broader than base of pronotum, broadest point at about basal fourth, and sides evenly rounded and narrowed to apex. Humeri not gibbous. Convexity of elytra greatest on middle basal fourth. Each elytron with six distinct rows of stria punctures and a seventh row consisting of only three larger punctures; sutural stria gradually diverging from suture towards base, so that at base it is separated from side of scutellum by a distance equal to more than breadth of scutellum. Striæ not impressed except for sutural, which is feebly and narrowly impressed; stria punctures on basal half of disk round, shallow, about as coarse as facets of eyes, a sixth to a tenth as broad as intervals, and separated longitudinally by two to four diameters; towards apex these become slightly finer and sparser: on basal third behind humeri with a row of three much coarser punctures (seventh), and nearer sides on apical two-fifths with a row of four or five equally coarse punctures (eighth row!). Intervals flat; surface sparsely, microscopically punctate, not distinctly alutaceous. Scutellum feebly convex, triangular, and as long as broad (0.05 mm.). *Prosternum* with process becoming broader towards apex, so that at apex it is nearly twice as broad as exposed part of front coxa; apex broadly, shallowly, arcuately emarginate; surface with round to elongate punctures, which are often at least half again as coarse as largest of pronotum, and are nearly contiguous to (on middle of process) separated by more than one diameter. *Hypomera* punctate like sides of prosternum, but on outer half with punctures finer and sparser. *Mesosternum* with caudal discal part on same level as metasternum, and with a very distinct, trisinate anterior marginal line. *Metasternal* disk feebly, evenly convex and without a median longitudinal line; produced portion between middle coxæ very broad (middle coxæ are slightly more widely separated than front coxæ) and feebly rounded; sides punctate like sides of



prosternum, but slightly less coarsely and more sparsely so. *Abdomen* punctate like metasternum, but discal part of sternites with the punctures slightly denser and coarser: fifth sternite with caudal margin broadly rounded. *Legs* with tibiae only feebly broadened towards apex; outer apical angle of front tibia broadly rounded. Tarsi 4-segmented.

*Type.* In the British Museum (Nat. Hist.). Borneo: W. Sarawak, Mt. Matang, 17. i. 1914 (*G. E. Bryant*).

*Comparative Notes.* Only three species of *Pseudocerylon*, all from Sumatra, have been described. The new species may be distinguished from both *P. trimaculatum* Grouvelle (1897) and *P. bicolor* Grouvelle (1897) by its concolourous instead of maculate elytra. From *P. bouchardii* Grouvelle (1897) it may be distinguished by its larger size (2.3 mm. : 1.5 mm.), and not or only very feebly instead of deeply impressed elytral striae.

#### COCYLON, gen. nov.

Body broad, obovate, moderately strongly convex. Dorsal and ventral surface glabrous. *Head* nearly concealed from above by pronotum; with a poorly-developed antennal groove below each eye. Eyes large, very strongly convex, and with vertical diameter greater than horizontal. Antennae 11-segmented; club rather loosely 3-segmented; basal segment completely exposed from above. Labrum with exposed part transverse and feebly emarginate on middle of anterior margin; surface sparsely setose. Maxilla with palp 4-segmented; second segment much broader but slightly shorter than first; third segment nearly twice as long and broad as second; and terminal segment two-fifths as long and only about one-third as broad as third. Labium with postmentum undivided: palp 3-segmented, the second being about five times longer and broader than first or third. *Pronotum* (fig. 13) evenly convex; sides broadly explanate except near apex; apex narrow and moderately shallowly, arcuately emarginate; and base very shallowly sinuate on each side and in front of scutellum. *Elytra* without striae, but with coarse punctures arranged in rows. Intervals flat; sides broadly explanate and curved upwards except near apex. Scutellum with externally visible part large, subovate, and on same plane as adjacent

parts of elytra. *Prosternum* with part in front of anterior coxæ about three times as long as a front coxa; anterior margin very shallowly, arcuately emarginate for its entire breadth; process extending well beyond coxal cavities, and at apex rounded and feebly broadened; anterior coxal cavities narrowly open behind. *Meso-sternum* with caudal fifth of disk transversely gibbous and slightly raised above adjacent part of metasternum; anterior four-fifths of disk deeply depressed. *Meta-sternum* without a median longitudinal line. *Abdomen* with median anterior process of first sternite truncate and rather narrow (for the *Cerylonini*); first sternite without striæ, and slightly longer than metasternum or combined length of four following segments; sternites 2, 3, 4, and 5 subequal in length. *Legs* with coxæ only feebly projecting above surface, and external part of front and middle coxæ more or less round; front coxæ separated by about their breadth, middle coxæ scarcely more separated than front, and hind coxæ only about a third again as widely separated as middle. Femora very broad, those of hind legs being about half as broad as long. Tarsi 4-segmented; basal segment nearly as long as combined length of two following.

*Genotype.* *Coccilon charon*, sp. n.

*Comparative Notes.* The produced pronotum, which conceals most of the head from above, together with the broadly explanate sides of the pronotum and elytra, give this insect an altogether distinctive appearance. From all other genera, except *Glyptolopus* Erichson (1845), it may be distinguished by its 3-segmented antennal club, and from the latter by its transverse instead of strongly produced labrum, evenly convex instead of carinate and sulcate pronotum, and by its flat instead of carinate alternate elytral intervals.

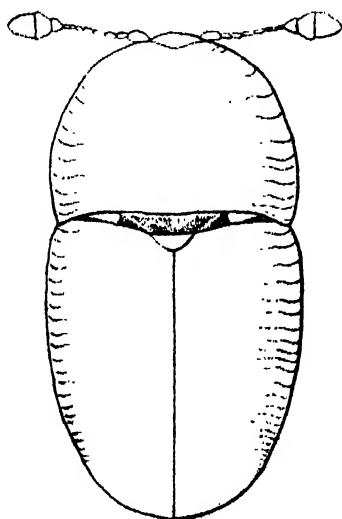
*Coccilon charon*, sp. n. (Fig. 13.)

Length 2.6 mm.; breadth 1.37 mm.

Body broadly obovate, moderately strongly convex. Cuticle strongly shining and reddish brown; antennæ and legs slightly paler and less reddish. Head with microscopic punctures, which are separated by two to three diameters; surface also scarcely noticeably ( $\times 75$ ) alutaceous. Antenna with segments 2 and 3 longer than broad and subequal

in length; 3 and 4 subequal but slightly shorter than 2 and 3; segments 6, 7, and 8 distinctly shorter than preceding segments, subequal in length, and nearly as broad as long; club with basal segment about three-fifths as broad as second, second transverse, and third as broad but much longer than second. Clypeus with anterior margin truncate, and surface moderately sparsely clothed with long, erect or suberect, testaceous hairs. *Pro-notum* across broadest point, which is at about basal fifth

Fig. 13.



13

*Coccilon charon*, sp. n.

or sixth, much broader than long (1.28 mm. : 0.87 mm.) and base three times as broad as apex (1.23 mm. : 0.38 mm.). Shape as shown in fig. 13. Surface microscopically punctate like head except as follows:—(1) a group of about twenty-three oval punctures, about as coarse as facets of eyes, extends from base opposite humerus to apical fourth or third; and (2) parallel to the latter a group of similar punctures, mostly before but partly in lateral explanate area, extends from near base to apical fourth or fifth. *Elytra* nearly twice as long as pronotum (1.61 mm. : 0.87 mm.) and with sides nearly parallel on basal

three-fifths. Humeri not distinctly gibbous. Each elytron with eight distinct rows of punctures and a ninth rather irregular row in explanate sides; first and second rows parallel to suture, extending from middle to apical third, and each consisting of about nine round punctures, which are as coarse as facets of eyes; third row extending from basal third to a point slightly before apical third, and consisting of twelve to thirteen slightly coarser punctures; fourth row extending from a point slightly behind middle nearly to base and consisting of about twelve punctures, which are slightly coarser than those of third; fifth row of ten punctures, which extend from base to near middle; sixth row similar to third; seventh row of about twenty-two punctures, which extend from near humerus to about apical third; and eighth row similar to seventh. Intervals flat; surface sparsely and very minutely (scarcely visible at  $\times 75$ ) punctate. Scutellum flat and surface only minutely punctate like adjacent elytral intervals. *Prosternum* with middle strongly and longitudinally convex; surface nearly smooth, at most with a few minute punctures and with an indistinct alutaceous microsculpture. *Hypomera* with a few minute punctures and also densely, very finely, obliquely alutaceous. Mesosternal disk nearly impunctate. Metasternum with disk feebly, evenly convex and nearly impunctate; sides with round, shallow punctures which are slightly coarser than facets of eyes, and are usually separated by less than one to one and a half diameters. *Abdomen* microscopically punctate except for sides of first sternite, which are coarsely punctate like sides of metasternum. *Legs* with basal sixth of all femora strongly and rather abruptly narrowed.

*Type.* In the British Museum (Nat. Hist.). Borneo: W. Sarawak, Mt. Matang, 4. ii. 1914 (*G. E. Bryant*).

#### PHILOTHERMUS Aubé.

1843. Ann. Soc. ent. Fr. (2) i, p. 93.

Only two new species of this genus, each represented by a unique, are in the Bornean material examined by me. These may be distinguished as follows:—

1. Species 1.56 mm. long. Antennal club with apical segment very distinct from basal. Clypeus with anterior margin truncate. Each elytron with seven rows of striae.

punctures. Hypomera everywhere coarsely punctate. Anterior coxal cavities narrowly open behind. Borneo ..... *Philothermus turissa*, sp. n.  
 Species 2.0 mm. long. Antennal club with apical segment closely united to basal so that club appears 1-segmented. Clypeus with anterior margin narrowly and deeply emarginate. Each elytron with eight rows of stria punctures. Hypomera with lateral half nearly smooth, only rarely with a coarse puncture. Anterior coxal cavities closed behind. Borneo ..... *P. fallax*, sp. n.

*Philothermus turissa*, sp. n.

Length 1.56 mm. ; breadth 0.60 mm.

Body subparallel and moderately feebly convex. Dorsal and ventral surface moderately sparsely clothed with fine, erect, testaceous hairs, which are usually slightly longer than basal antennal segment but are sometimes, particularly ventrally, only half as long. Cuticle strongly shining and rather dark rufo-piceous ; antennæ and legs slightly paler. Head with moderately shallow, round to oval punctures which are about a third coarser than facets of eyes, and are contiguous to separated by nearly one diameter ; surface between punctures nearly smooth ( $\times 75$ ). Antenna with second and third segments subequal in length, but second slightly broader ; segments 4, 5, 6, 7, and 8 subequal, but becoming slightly broader distally ; ninth nearly twice as broad as eight and strongly transverse ; club obovate, basal segment transverse and only about three-fifths as long as apical. Clypeus with anterior margin truncate ; surface only sparsely and microscopically punctate. Labrum feebly produced and with middle apical margin emarginate. Pronotum across broadest point, which is at about basal fourth, broader than long (0.59 mm. : 0.43 mm.) and base broader than apex (0.54 mm. : 0.41 mm.). Sides evenly arcuate and coarsely, deeply margined ; apex truncate when seen from above, not margined ; base very broadly and very shallowly sinuate on each side. Surface evenly convex but nearly flat on disk ; punctures usually round, seldom distinctly oval, shallow, slightly but distinctly coarser than those of head, and usually separated by one-half of one to one diameter ; surface between punctures smooth or very finely, indistinctly alutaceous. Elytra slightly more than twice as long as pronotum (1.04 mm. : 0.43 mm.), base very slightly broader than base of pronotum, in basal

two-thirds sides are nearly parallel, and broadest point is at about apical two-fifths. Humeri only feebly gibbous. Each elytron with seven rows of stria punctures. Striae not or only scarcely impressed; stria punctures on basal half of disk about as coarse as those of pronotum, slightly deeper, one-half to two-thirds as broad as intervals and separated longitudinally, usually by slightly less than their diameters; towards apex these punctures become much finer and distinctly sparser, and at sides slightly coarser. Intervals flat; surface with a few sparse microscopic punctures, but near sides with a few minute granules. Scutellum transverse, semicircular and impunctate. Prosternum punctate, similarly to pronotal disk; process feebly broadened and rounded at apex. Hypomera punctate like prosternum, but slightly more finely and sparsely so on caudal fourth. Mesosternal disk shallowly depressed except on caudal fourth, which is on same level as metasternum. Metasternal disk nearly flat; median longitudinal line narrow and confined to caudal two-fifths; anterior middle feebly and narrowly produced between coxæ (middle coxæ closer together than front coxæ); surface with punctures like those of pronotal disk, but usually separated by one to two diameters; sides similarly but much more densely punctate than disk. Abdomen with sternites punctate like metasternum, but middle region of each slightly more densely so; apical margin of fifth sternite broadly rounded.

*Type.* In the British Museum (Nat. Hist.). Borneo: W. Sarawak. Mt. Matang, xii. 1913 (G. E. Bryant).

*Philothermus fallax*, sp. n.

*Male.*—Length 2.0 mm.; breadth 0.84 mm.

Body subparallel and moderately strongly convex. Dorsal and ventral surface moderately sparsely clothed with fine, erect, testaceous hairs, which are usually only about half as long as basal antennal segment, but are sometimes nearly as long. Cuticle strongly shining and rather dark rufo-piceous; antennæ and legs slightly paler and less reddish. Head with moderately shallow, round punctures which are about as coarse as facets of eyes and are separated by one to two diameters; surface between

punctures smooth or nearly so. Antenna with segments 2 and 3 subequal in length, but 2 distinctly broader than 3; segments 4, 5, 6, 7, and 8 feebly transverse, and distal segments slightly larger than proximal; segment 9 transverse and a third again as long and broad as 8; club oblong-oval, with basal and apical segments closely united so that they do not appear moveable, the apical being slightly but distinctly longer than basal. Clypeus with anterior margin moderately narrowly and deeply emarginate at middle; surface only with a few sparse microscopic punctures. Labrum moderately produced and apex feebly emarginate. *Pronotum* across broadest point, which is at about middle, broader than long (0.79 mm. : 0.60 mm.), and base broader than apex (0.71 mm. : 0.49 mm.). Sides evenly, strongly arcuate and moderately coarsely and deeply margined; apex more or less truncate when seen from above, not margined; base broadly and shallowly but distinctly sinuate on each side, and rounded in front of scutellum. Surface evenly convex from side to side; punctures shallow, round, slightly coarser than those of head, and usually separated by two but sometimes by three diameters; sides with punctures distinctly coarser and denser, here usually being separated by one diameter or less; surface between punctures smooth. *Elytra* twice as long as pronotum (1.23 mm. : 0.60 mm.), base slightly broader than base of pronotum, and sides feebly and evenly rounded, the broadest point being between basal third and fourth. Humeri only feebly gibbous. Each elytron with eight parallel rows of strial punctures; first row diverging outwards near base to end at side of scutellum. Striæ at most feebly impressed; strial punctures on basal half of disk as coarse as those of sides of pronotum, slightly deeper, about half as broad as intervals, and separated longitudinally by two to three diameters; towards apex these punctures become slightly sparser and distinctly finer, and towards sides denser and coarser. Intervals flat; surface with a few sparse, minute punctures. Scutellum feebly transverse, sub-ovate and impunctate. *Prosternum* with middle very strongly (for this genus) convex; surface punctate like sides of pronotum; sides near hypomera more densely and coarsely punctate; process rounded and very feebly broadened at apex. Hypomera smooth, or at most with

only fine punctures on outer half; inner half with numerous fine and very coarse punctures intermixed. Mesosternal disk with caudal fifth or sixth on same level as metasternum, but all of anterior part on a much lower level. Metasternal disk nearly flat; median longitudinal line narrow and confined to caudal two-fifths; anterior middle strongly and narrowly produced between coxæ (middle coxæ nearly contiguous, nearer together than front coxæ); surface sculptured like pronotal disk, but slightly more sparsely punctate; sides punctate like sides of pronotum, not as coarsely punctate as sides of prosternum. *Abdomen* with sternites slightly more densely punctate than metasternum, 2, 3, and 4 each with two transverse rows of coarse punctures; first sternite without striæ, fifth sternite with apex broadly rounded and disk shallowly, transversely depressed. *Legs* with external apical angle of front tibia feebly toothed.

*Type.* A male in the British Museum (Nat. Hist.). Borneo: W. Sarawak, Mt. Matang, 16. i. 1914 (*G. E. Bryant*).

*Comparative Notes.*—This species is close to *P. turissa*, sp. n., and, in addition to the differences given in the key, it may be distinguished by its noticeably more convex body, relatively shorter pubescence of the dorsal surface, and more sparsely punctate head and pronotum.

#### CERYLON Latreille.

1802. *Cerylon* Latreille, Hist. Nat. Crust. Ins. iii. p. 228.

1854. *Plæosoma* Wollaston, Ins. Mader. p. 147 (*new synonymy*).

1885. *Pachylon* Sharp, Journ. Linn. Soc. Lond. xix. p. 79 (*new synonymy*).

The types of both *Plæosoma* Wollaston and *Pachylon* Sharp have been examined, and they do not differ from *Cerylon* in any character that can be considered to be of generic importance. I have retained the genus *Philothermus* Aubé, which differs from *Cerylon* only in having a 2- instead of 1-segmented antennal club, but when further species are discovered it will probably have to be united to *Cerylon*. Already there appears to be nearly every degree between the tenth and eleventh segments being very loosely joined on the one hand, and on the other so closely fused as to be indistinguishable, even when cleared with potash.



Key to the Bornean Species of *Cerylon*.

1. All tarsi 3-segmented. (Dorsal and ventral surface glabrous. Antenna with third segment very nearly as long as second. Anterior margin of clypeus truncate or nearly so. Pronotum evenly and feebly convex, without sublateral impressions. Each elytron with six rows of stria punctures; discal rows distinctly arcuate. Anterior coxal cavities completely closed behind. Abdomen with lateral striae of first sternite distinct and nearly extending to second segment.) China, India, Ceylon, Malaya, Borneo, Madagascar ... [(1885).  
*C. quadricolle* Sharp
  2. All tarsi 4-segmented ..... 2.
2. Species more than 2.8 mm. long. Dorsal surface glabrous. Pronotum with a longitudinal sublateral sulcus on each side. Each elytron with only six rows of stria punctures. Anterior coxal cavities moderately widely open behind. Metasternal disk with a well-developed anterior marginal line. First abdominal sternite with a nearly complete stria on each side. .... 3.
  - Species less than 2.8 mm. long. Dorsal surface with at least apex of elytra pubescent. Pronotum evenly convex from side to side, without sublateral sulci. Each elytron with seven rows of stria punctures. Anterior coxal cavities closed or only narrowly open behind. Metasternal disk without or only with an indistinct anterior marginal line (except in *C. variolosa*, sp. n.). First abdominal sternite without striae .... 4.
3. Elytra with a broad and moderately shallow but distinct depression behind scutellum; first and second striae extending from near apex to basal half; sides, when seen from above, scarcely noticeably rounded on basal half. First abdominal sternite with coarse lateral punctures distinctly obovate. Female with external apical angle of front tibia broadly rounded, not toothed. Borneo ..... *C. bryanti*, sp. n.
  - Elytra flat or feebly convex behind scutellum, without trace of a depression; first row of punctures extending from near apex to a point which is about one length of scutellum behind scutellum and second row extending very nearly to base; sides, when seen from above, noticeably rounded at broadest point of elytra, which is between basal fourth and fifth. First abdominal sternite with coarse lateral punctures round, or at most very broadly oval. Female with external apical angle of front tibia (fig. 17) distinctly toothed. Borneo ..... [subsp. n.  
*C. torosum borneense*,

4. Pronotum with anterior margin, when seen from above, nearly truncate; surface with irregular-shaped punctures four or five times as coarse as facets of eyes and seldom separated by more than one-fourth of a diameter. Borneo ..... *C. variolosa*, sp. n.
- Pronotum with anterior margin, when seen from above, deeply and broadly emarginate; surface with punctures round, never more than twice as coarse as facets of eyes, and frequently separated by more than one diameter ..... 5.
5. Body oblong and subparallel. Head with a transverse ridge above antennal bases and clypeus vertical, *e. g.*, on a plane which is nearly at right-angles to front; middle anterior margin of clypeus with a moderately shallow, arcuate emargination; surface of head with punctures only slightly coarser than facets of eyes. Borneo ..... *C. frontale*, sp. n.
- Body broadly oblong-oval. Head without a transverse anterior ridge and clypeus nearly on same plane as front; middle anterior margin of clypeus (fig. 24) with a very deep, subtruncate emargination; surface of head with punctures twice as coarse as facets of eyes. Borneo ..... *C. suilla*, sp. n.

*Cerylon quadricolle* Sharp (1885).

Two specimens have been examined from Borneo: W. Sarawak, Mt. Matang, i. 1914 (*G. E. Bryant*). These specimens are slightly smaller (length 1.37 mm.; breadth 0.52 mm.) than the Indian and Malayan examples available, but otherwise agree fairly closely.

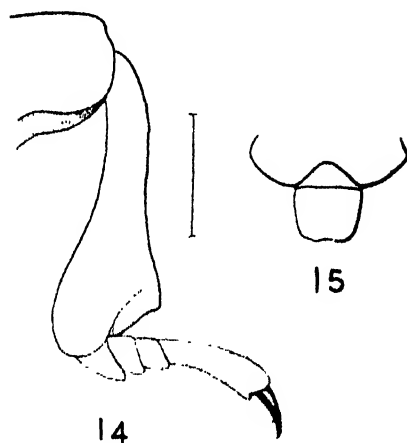
*Cerylon bryanti*, sp. n. (Figs. 14 & 15.)

*Female*.—Length 3.0 mm.; breadth 1.09 mm.

Body nearly parallel, dorsally moderately depressed. Dorsal and ventral surface glabrous. Cuticle strongly shining and moderately dark rufo-piceous: apical half of elytra and tarsi paler and more castaneous. *Head* with round to oval, moderately shallow punctures, which are about two-thirds as coarse as facets of eyes and are usually separated by two to three diameters, but at sides near eyes are slightly denser; surface also with much finer (about half as coarse) and sparser punctures, these being particularly evident on middle of front; surface between punctures smooth. Antenna with third segment about one-third longer than second; club nearly round in

outline. Clypeus (fig. 15) with anterior margin broadly and rather deeply, arcuately emarginate; surface slightly more finely and sparsely punctate than head. Labrum with anterior margin very shallowly emarginate at middle. *Pronotum* across broadest point, which is at about apical fourth, broader than long (1.01 mm. : 0.82 mm.), and base broader than apex (0.96 mm. : 0.68 mm.). Sides feebly arcuate and finely and narrowly margined; apex moderately shallowly, arcuately emarginate for entire breadth

Figs. 14 &amp; 15.

*Cerylon bryanti*, sp. n.

14. Anterior view of front leg. 15. Clypeus and labrum.

and finely margined except on middle half; base broadly, moderately shallowly sinuate on each side, feebly and evenly rounded in front of scutellum and finely and completely margined. Surface with a broad and deep sublateral depression extending on each side from base to apical third or slightly beyond. Disk with punctures of sides of head and separated by one to two diameters; caudal half of disk much more finely and sparsely punctate; region in front of depression with about 14-16 punctures, as coarse or slightly coarser than facets of eyes; sides only sparsely, microscopically punctate; between

punctures with a more or less longitudinal, feebly impressed, dense, very fine (scarcely visible at  $\times 75$ ) alutaceous microsculpture. *Elytra* more than twice as long as pronotum (2.00 mm. : 0.82 mm.), at base only slightly broader than base of pronotum, and broadest point at about basal third, though elytra are more or less parallel in basal half; basal fourth behind scutellum with a broad (embracing first two intervals on either side of suture) shallow, but distinct depression. Humeri not gibbous. Each elytron with six well impressed striae; sutural stria obsolete before basal half; second stria ending before basal two-fifths; four lateral striae coarser and extending nearly to base, the fourth, fifth, and sixth being noticeably curved inwards near base. Strial punctures round, shallow, a sixth to a tenth as broad as intervals, and separated longitudinally by two to five diameters: punctures of lateral striae distinctly coarser and slightly denser. Intervals flat; surface with microscopic punctures separated by two to five diameters. Scutellum flat, semicircular, and broader than long (0.16 mm. : 0.12 mm.); surface only with a few microscopic punctures. *Prosternum* with process nearly as broad as exposed part of front coxa, and broadly rounded behind; anterior coxal cavities moderately widely open behind; surface on middle punctate like pronotal disk, but on sides with round, shallow punctures, which are about half as coarse as facets of eyes and are separated by one-fourth of one to nearly one diameter. *Hypomera* with punctures two-thirds as coarse as facets of eyes and separated by two to three diameters, though sparser and finer caudally; from each puncture a very short, fine, erect hair arises; surface between punctures with alutaceous microsculpture, similar but more evident than that of pronotum. *Mesosternum* with only extreme caudal part of disk elevated to level of metasternum; surface nearly smooth. *Metasternal* disk only feebly convex, median longitudinal line confined to caudal fourth, anterior middle thickly and very distinctly margined, and surface punctate like middle of head; sides with anterior half nearly as coarsely punctate as sides of prosternum, and caudal half no more coarsely punctate than disk. *Abdomen* with lateral sulci of first sternite moderately broad, feebly diverging posteriorly, and extending to

caudal sixth of segment. Middle of sternites punctate like metasternal disk, but sides much more coarsely and densely so; lateral punctures of first sternite distinctly oval (twice as long as broad), rarely nearly round. Legs with middle coxæ very slightly closer than front coxæ; hind coxæ twice as far apart as middle coxæ. Front tibia (fig. 14) strongly broadened apically and external apical angle feebly, obtusely toothed. Tarsi 4-segmented.

*Type.* Female in British Museum (Nat. Hist.). Borneo: W. Sarawak, Mt. Matang, ii. 1914, alt. 2,000 ft., under bark with *Volenhovia rufiventris* Forel (*G. E. Bryant*).

*Comparative Notes.* This species can only be compared with *C. torosum torosum* Reitter (1889), from which it may be distinguished as follows: (1) elytra depressed instead of flat behind scutellum; (2) first and second elytral striæ confined to apical half or three-fifths instead of extending at least to basal fourth; and (3) coarse lateral punctures of first abdominal sternite strongly oval instead of round or nearly so.

The occurrence of this species in an ant's nest is probably accidental. The European *C. histeroïdes* Fabricius has been found in ant nests a few times, but this is not its normal habitat.

*Cerylon torosum borneensis*, subsp. n.  
(Figs. 16 & 17.)

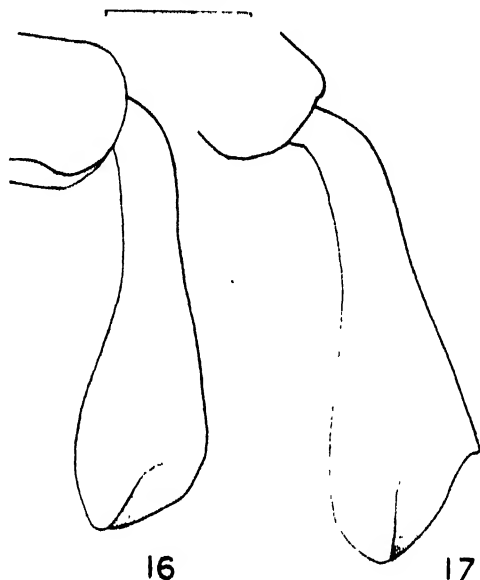
*Male.*—Length 3.3 mm.; breadth 1.53 mm.

Closely similar to *C. torosum torosum* Reitter, of Sumatra, Java and Malaya, but differs in the following particulars:—(1) the elytra are distinctly rounded in basal half, being noticeably so at broadest point, which is at basal fourth, whereas in *C. torosum torosum* they are feebly rounded or nearly parallel in basal half and, when seen from above, are not strongly rounded at broadest point; (2) the male has no tubercle on disk of first abdominal sternite; and (3) the front tibia of the male (fig. 16) is evenly broadened from about basal two-fifths towards apex, instead of being suddenly dilated at middle.

*Female.*—Externally similar to male except as follows:—(1) disk of first abdominal sternite with a low, indistinct tubercle; (2) apical half of fifth abdominal sternite not

depressed, and only slightly more densely punctate than basal half; and (3) apical external angle of front tibia feebly and obtusely toothed instead of broadly rounded.

Figs. 16 &amp; 17.

*Cerylon torosum borneensis*, subsp. n.

16. Anterior view of front tibia of male.

17. Same of female.

*Type.* A male in the British Museum (Nat. Hist.). Borneo: W. Sarawak, Quop, iii. 1914 (*G. E. Bryant*).

*Paratypes.* One male and one female, with same data as above.

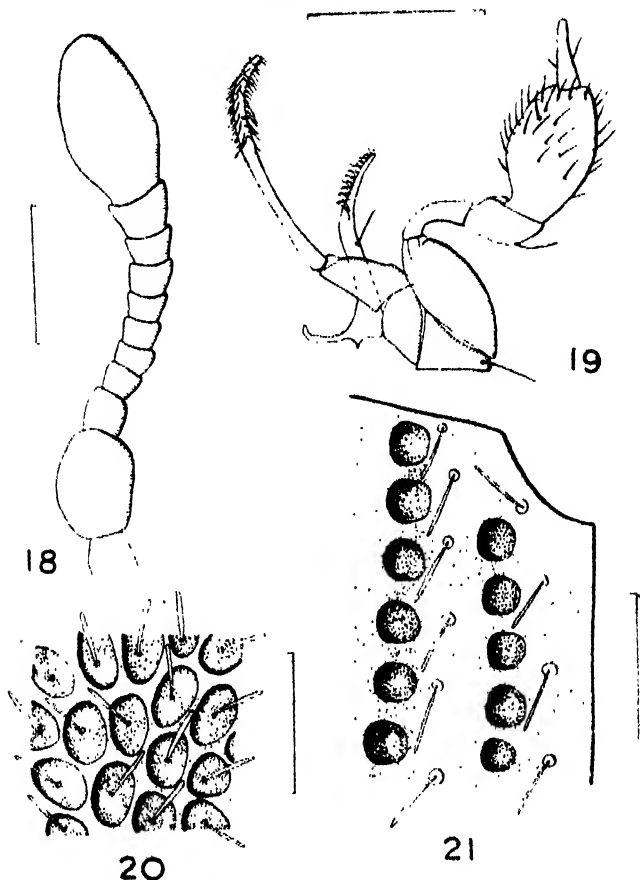
*Cerylon variolosa*, sp. n. (Figs. 18–21.)

Length 2.6 mm.; breadth 1.42 mm.

Body broadly oval and very strongly convex. Dorsal surface moderately sparsely clothed with stout, erect, testaceous setæ, which are nearly as long as basal segment of antenna; ventral surface with setæ much finer, slightly shorter, and often recumbent. Cuticle moderately shining and dark rufo-piceous to nearly black; antennæ and legs paler and more reddish.

*Head* with round, moderately deep, nearly contiguous punctures, which are half again as coarse as facets of eyes; on middle of front with punctures distinctly smaller and

Figs. 18-21.



*Cerylon variolosa*, sp. n.

18. Antenna. 19. Ventral view of maxilla. 20. Section of middle disk of pronotum. 21. Basal part of first two intervals of elytron.

often separated by one diameter; surface between punctures microscopically and often rather densely punctate. Antenna (fig. 18) with third segment distinctly

narrower and shorter than second ; club oblong-oval, and about twice as long as broad. Clypeus with anterior margin broadly, evenly rounded ; surface with only an occasional puncture, about half as coarse as those of head. Labrum feebly produced ; anterior margin moderately deeply, arcuately emarginate at middle. *Pronotum* across broadest point, which is at about apical third, broader than long (1.07 mm. : 0.87 mm.), and base broader than apex (1.01 mm. : 0.71 mm.). Sides rounded, nearly straight before base, very finely margined on apical fourth, and near middle with three or four obtuse teeth on margin ; apex nearly truncate, nowhere distinctly margined ; base rounded in front of scutellum, shallowly and very broadly sinuate on each side, and without a distinct marginal line. Surface with shallow, round to irregular but usually more or less oblong-oval, flat-bottomed, coarse (about as broad as second antennal segment), nearly contiguous punctures, each of which has a low, more or less median tubercle, from which arises a stout seta as shown in fig. 20 ; surface between coarse punctures with a few extremely minute punctures. *Elytra* twice as long as pronotum (1.75 mm. : 0.87 mm.), base distinctly broader than base of pronotum, and from base gradually becoming broader to broadest point, which is at about basal third, and thence rounded and narrowed to apex. Humeri broadly and very feebly gibbous. Each elytron with seven striae, which are feebly impressed on disk and moderately strongly impressed at side : strial punctures on basal half of disk deep, round to subquadrate, one-half as broad to as broad as intervals, and separated longitudinally by about one-half a diameter (fig. 21) : towards apex these punctures become slightly finer, and towards sides distinctly coarser and denser. Intervals on disk flat and on sides feebly convex ; surface of each with a single sparse row of low, indistinct, setose tubercles, which are about as coarse or slightly coarser than facets of eyes. Scutellum flat, broadly oval with base truncate, and broader than long (0.14 mm. : 0.11 mm.). *Prosternum* with process between front coxae slightly narrower than exposed part of a front coxa, and at apex distinctly broadened and feebly rounded ; anterior coxal cavities very narrowly open behind ; surface on middle and sides punctate like caudal sides of head. Hypomera with punctures as



coarse as those of prosternal sides, but separated by one-half of one to one or more diameters. Mesosternum with only extreme caudal part of disk elevated to level of metasternum; surface of caudal process nearly smooth. Metasternal disk moderately convex; median longitudinal line nearly complete, but only feebly impressed; anterior middle thickly and very distinctly margined; and surface with round, moderately deep punctures, slightly coarser to slightly finer than facets of eyes; surface between coarse punctures with numerous extremely minute punctures; sides punctate like middle of hypomera. *Abdomen* without lateral sulci on first sternite. Surface of sternite punctate similarly to metasternal disk; sides of first with punctures arranged in three transverse rows; sides of four apical sternites with two more or less transverse rows of punctures; middle of second and third sternite with only one transverse row of punctures. *Legs* with middle coxæ as close as front coxæ, and hind coxæ nearly twice as wide apart. Front tibia (in female at any rate) no broader at apex than at middle. Tarsi 4-segmented.

*Type.* In the British Museum (Nat. Hist.). Borneo (*Doherty*).

*Paratype.* Female with same data as above.

*Comparative Notes.* This is unlike any other species known to me. Its setose dorsal and ventral surface, truncate anterior margin of pronotum, oblong-oval antennal club, and extremely coarsely and densely punctate pronotum will serve to distinguish it from all other described species.

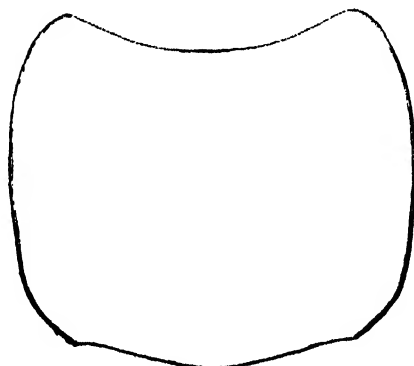
*Cerylon frontale*, sp. n. (Fig. 22.)

*Male.*—Length 1.9 mm.; breadth 0.71 mm.

Body elongate, subparallel, moderately convex. Dorsal surface glabrous except for a few sparse, fine, short, erect, testaceous hairs on apical half of elytra; ventral surface glabrous. Cuticle shining and moderately pale reddish brown. *Head* with a distinct, transverse, arcuate ridge extending between anterior margins of eyes; surface with round, shallow punctures, which are as coarse or slightly coarser than facets of eyes and are contiguous to separated by about one-half a diameter. Antenna with third segment distinctly narrower and slightly longer than second;

club broadly oval. Clypeus nearly vertical, i. e., on a plane which is at about right angles to front; anterior margin shallowly, arcuately emarginate on middle; surface sparsely microscopically punctate. Pronotum across broadest point, which is at about middle, broader than long (0.65 mm. : 0.52 mm.), and base broader than apex (0.54 mm. : 0.46 mm.). Shape as shown in fig. 22. Middle of disk with round punctures, slightly deeper and scarcely noticeably finer than those of head and separated by one to two diameters; sides punctate like head; surface between coarse punctures densely, microscopically punctate. Elytra slightly more than twice as long as pronotum

Fig. 22.



22

*Cerylon frontale*, sp. n.

Outline of pronotum.

(1.18 mm. : 0.52 mm.), at base distinctly broader than base of pronotum, and from base becoming broader posteriorly to broadest point, which is at about basal third. Humeri not noticeably gibbous. Each elytron with seven feebly impressed, but strongly punctate, more or less parallel striae, which extend from near base to near apex (the row of punctures usually found in *Cerylon* contiguous to inner margin of epipleura is never considered to be a stria row); inner side of apical half of fifth row with a row of close, nearly equally coarse punctures (if this is considered

to be a stria row, then apical half of each elytron has eight and not seven rows of punctures). Strial punctures on basal half of disk deep, round, one-half to four-fifths as broad as intervals, and separated longitudinally, usually by one-half of one to one diameter; towards apex these punctures become distinctly finer and sparser, and towards sides coarser and denser. Intervals flat and with numerous extremely minute punctures. Scutellum flat, broadly oval with base truncate, and broader than long (0.082 mm.:0.055 mm.). Prosternum with process between coxæ about as broad as exposed part of a front coxa, and at apex rounded and distinctly broadened; anterior coxal cavities very narrowly open behind; surface on middle punctate like sides of pronotum; sides distinctly more coarsely punctate. Hypomera finely, densely, reticulately alutaceous, and with a few fine, indistinct punctures. Mesosternum with only extreme caudal part of disk elevated to level of metasternum; surface of middle caudal process of disk nearly smooth. Metasternal disk flat; median longitudinal line confined to caudal seventh; anterior middle narrowly produced forwards to meet process of mesosternum; and surface with punctures like those of pronotal sides, but usually separated by two to four diameters; sides sculptured like sides of prosternum, but with coarse punctures often separated by as much as one diameter. *Abdomen* without lateral sulci on first sternite. Middle of sternites punctate for the most part like pronotal disk; sides of first two sternites much more coarsely punctate. *Legs* with middle coxæ slightly closer than front coxæ, and hind coxæ two-and-a-half times as widely separated. Front tibia strongly and evenly broadened to apex, internal apical angle distinct and produced, external apical angle rounded, and on middle ventral side near apex with a narrow, low, longitudinal tubercle; front and middle tibiæ with a narrower and shorter tooth on internal apical angle. Tarsi 4-segmented.

*Type.* A male in the British Museum (Nat. Hist.). Borneo: W. Sarawak, Mt. Matang, i. 1914 (*G. E. Bryant*).

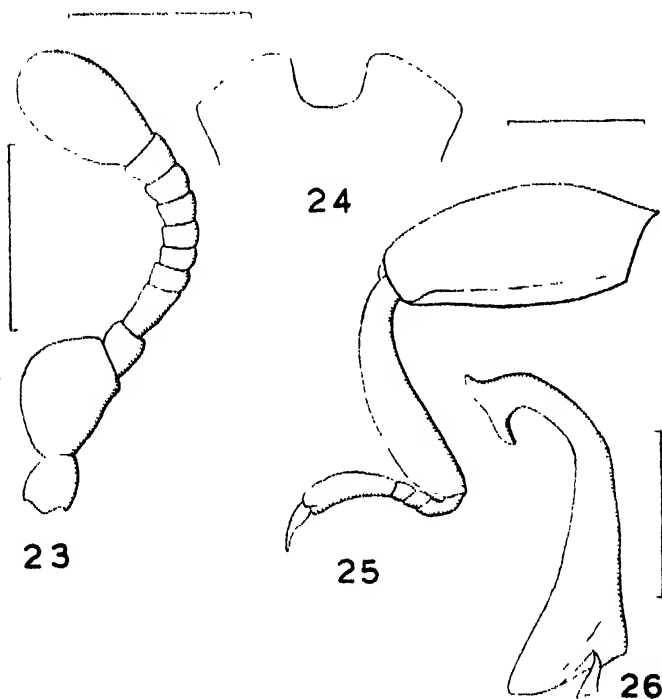
*Comparative Notes.* The frontal ridge on the head and the unusually shaped pronotum (fig. 22) will serve to distinguish it from all other described species.

*Cerylon suilla*, sp. n. (Figs. 23-26.)

*Male*.—Length 1.67 mm. ; breadth 0.96 mm.

Body broad, oblong-oval, moderately convex. Dorsal surface sparsely clothed with fine, erect, testaceous hairs, which are usually slightly longer than basal segment of

Figs. 23-26.



*Cerylon suilla*, sp. n.

23. Antenna. 24. Anterior margin of clypeus. 25. Anterior view of front leg. 26. Left lateral view of male genitalia.

antenna ; ventral surface much more sparsely clothed with finer hairs, which are usually not more than half as long as those of dorsal surface. Cuticle strongly shining and moderately pale to moderately dark rufo-piceous. *Head*

with round or oval shallow punctures, which are sometimes twice as coarse as facets of eyes and are contiguous to separated by more than one diameter; surface between punctures scarcely visibly (mag.  $\times 75$ ), alutaceous, and only with an occasional microscopic puncture. Antenna (fig. 23) with third segment narrower and nearly twice as long as second; club oblong-oval, not twice as long as broad. Clypeus with anterior margin (fig. 24) very broadly, deeply, and subtruncately emarginate; surface with a few punctures, which are finer than facets of eyes. *Pronotum* across broadest point, which is at apical two-fifths or one-third, much broader than long (0.85 mm. : 0.53 mm.), and base broader than apex (0.76 mm. : 0.45 mm.). Sides strongly, evenly rounded, but nearly straight before base and finely, completely margined; apex deeply emarginate (middle two-fifths of emargination being nearly truncate) and finely margined at sides; base very broadly, shallowly sinuate on each side and rounded in front of scutellum, not margined. Disk with round, moderately shallow punctures, slightly coarser than those of head and separated by one to four diameters; sides with punctures very slightly coarser but much denser; surface between punctures, smooth or only with an occasional microscopic puncture. *Elytra* twice as long as pronotum (1.09 mm. : 0.53 mm.), at base slightly but distinctly broader than base of pronotum, and strongly broadened and rounded to broadest point which is at basal third. Humeri not distinctly gibbous. Each elytron with seven rows of stria punctures, which are more or less parallel; first row diverging outwards near base so that it ends some distance lateral to sides of scutellum. Strial punctures on basal half of disk round, moderately shallow, three-fourths as coarse as those of pronotum, one-fourth to one-half as broad as intervals, and separated longitudinally by one to two diameters; at sides punctures are coarser and denser, and towards apex finer and sparser. Intervals flat, region between seventh and inner margin of epipleura distinctly convex; surface of intervals smooth, only with an occasional microscopic puncture. Scutellum flat, subovate, broader than long (1.09 mm. : 0.055 mm.). *Prosternum* with process nearly twice as broad as exposed part of a front coxa,

distinctly broadened behind, narrowly sinuate before caudal angles, which are produced laterally, and with apex shallowly, arcuately emarginate for entire breadth; anterior coxal cavities closed behind; surface slightly more deeply and coarsely punctate than sides of pronotum. Hypomera with punctures often coarser than those of sides of prosternum, and seldom separated by more than half a diameter; coarse punctures absent from a moderately wide lateral belt; surface of lateral belt, as well as that between coarse punctures, with punctures nearly as coarse as facets of eyes, and seldom separated by more than one diameter. Mesosternum with only caudal part of disk elevated to level of metasternum, the apex of this part being broad and nearly truncate. Metasternal disk flat or nearly so; median longitudinal line absent or scarcely noticeably impressed and confined to caudal two-fifths; and disk only with an occasional microscopic puncture except near anterior margin, where there is a row of very close and coarse punctures; sides of metasternum as coarsely and densely punctate as hypomera. *Abdomen* without sulci on first sternite; first sternite at sides punctate like sides of metasternum, on disk with coarse punctures sparser; middle of sternites two to five, with punctures only half as coarse as those of first sternite and sparser. *Legs* with middle coxæ slightly closer than front coxæ; hind coxæ not quite twice as far apart as middle coxæ. Front tibiæ evenly broadened towards apex, apical half subparallel, and external apical angle rounded. *Tarsi* (fig. 25) 4-segmented.

*Female*.—Externally similar to male.

*Type*. In the British Museum (Nat. Hist.). Borneo: W. Sarawak, Mt. Matang, xii. 1913 (*G. E. Bryant*).

*Paratypes*. Six with same data as above, but two collected in i.-ii. 1914.

*Comparative Notes*. From all Bornean species it may be distinguished as shown in the key given above. It is close to none of the species known to me from other regions.

XVII.—*Cladocera and Copepoda collected from East African Lakes by Miss C. K. Ricardo and Miss R. J. Owen.* By J. P. HARDING, Ph.D., British Museum (Natural History).

THE following paper is an account of the Cladocera and Copepoda collected from certain lakes in Northern Rhodesia and Tanganyika Territory.

The collection consisted of twenty-nine tubes of plankton samples from Lake Young (Shiwa Ngandu), Lake Chila, Lake Rukwa, and Lake Tanganyika. From this material thirteen species of Cladocera and fifteen species of Copepod were separated. There were four new species, all from Lake Young, one new Cladoceran, and three new Copepods.

I wish to express my thanks to Miss Ricardo for allowing me to search through this valuable plankton.

#### LIST OF SPECIES.

The letters, Y, C, R, and T stand for the four lakes Young, Chila, Rukwa, and Tanganyika respectively.

#### CLADOCERA.

- Diaphanosoma owenæ*, sp. n., Y.
- Daphnia* (*Hyalodaphnia*) *barbata*, R.
- Simocephalus* sp., Y.
- Ceriodaphnia cornuta*, Y, R.
- Moina dubia*, R.
- Macrothrix chevreuxi*, Y.
- Ilyocryptus spinifer*, Y.
- Bosmina longirostris*, Y.
- Bosminopsis deitersi*, Y, C.
- Alona* sp., Y.
- Alonella exigua*, Y.
- *punctata*, R.
- Chydorus* cf. *eurynotus*, Y.

#### COPEPODA.

- Paradiaptomus* (*Lovenula*) *africanus*, R.
- Diaptomus* (*Tropodiaptomus*) *kræpelini*, R.
- *simplex*, T.
- (*Thermodiaptomus*) *ricardoe*, sp. n., Y.

- Macrocylops albidus* var. *oligolasius*, Y.  
*Tropocylops prasinus* var. *tenellus*, Y, C.  
*Eucyclops parvicornis*, sp. n., Y.  
— *spatharum*, sp. n., Y.  
— *euacanthus*, Y.  
— *gibsoni*, Y.  
*Ectocylops compactus*, Y.  
*Microcylops attenuatus*, T.  
*Mesocylops leuckarti*, R.  
— *neglectus*, Y.  
*Ergasiloides* cf. *brevimanus*, T.

## DESCRIPTION AND DISTRIBUTION OF SPECIES.

*Diaphanosoma owenæ*, sp. n.

Types in British Museum (Natural History).

*Female*.—(Figs. 1-4), length 650-750  $\mu$ .

The *head* of most of the specimens was rather distorted by preservation, but the normal shape is believed to be that shown in fig. 1. Eye comparatively large; its diameter about two-thirds the width of the head in the eye region. *Second antenna* reaching nearly or quite to the hind margin of the shell. *Shell* (figs. 1, 3, 4): ventral edge incurved, with a broad hyaline margin, the anterior part of which is naked, while the posterior incurved part has about seven backwardly directed feathered setæ. Post-ventral margin of shell with about ten hyaline teeth starting from the point of inflection. These teeth are curved backwards slightly, and between each of them is one (sometimes more) minute spinule, and one extremely fine naked hair. These hairs are 20-30  $\mu$  long, and are continued along the hind edge of the shell beyond the last of the teeth at intervals of about 15  $\mu$ . Minute setules and spinules about 2  $\mu$  long are found in a row along the inside of the hyaline margin and also on its extreme edge (fig. 4); these latter are similar to the minute spinules between the teeth. *Tail* of usual form. Minute hairs are present in groups along the side (fig. 2).

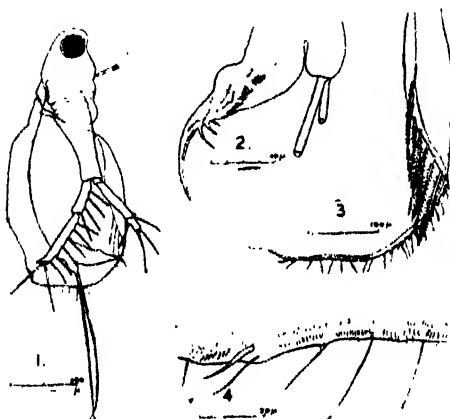
*Locality*.—Lake Young. Samples of plankton were taken from Lake Young in August and November 1936, and January and February 1937. *D. owenæ* was present in large numbers in all four months. Females with



embryos were present only in the November samples. Adults with eggs were also present in February.

*Affinities.*—*D. owenæ* is very similar to *D. excisum* Sars. It differs from the latter most conspicuously in the presence of the fine hairs on the posterior edge of the shell. The shape of the head is also rather different, and the adult size is a little smaller. The fine hairs on the sides of the tail run in a direction at right angles to the axis of the tail, and not parallel with it as they do in

Figs. 1-4.



*Diaphanosoma owenæ*.

1. Adult female. 2. Tail. 3. Post-ventral part of left shell.  
4. Posterior margin of shell.

*D. excisum* var. *stingelini* Jenkin (in Ann. & Mag. Nat. Hist. ser. 10, xiii, pp. 137-160 & 281-308, 1934). Hansen's description (in Ergebn. Plankton-Exped. d. Humboldt-Stiftung, iii. G.d. 1-58, 1899) of *D. fluviatile* agrees quite closely with this species, it has the inflected ventral margin of the shell, and the posterior part of the shell has very fine hairs; but there appear to be no teeth on the post-ventral curve, and the eye of *D. fluviatile* is small. The arrangement of the feathered setae, the teeth, spinules, and fine hairs is very similar to that of *D. perarmatum* Brehm (in Arch. Hydrobiol. Suppl. Band. xi.

pp. 631-770, 1933). The ventral margin of *D. perarmatum* is not incurved, however.

*Daphnia (Hyalodaphnia) barbata* (Weltner).

This species which is known from East and South Africa was abundant in all plankton samples from Lake Rukwa, and also in the stomachs of the fish *Synodontis*. Daday ('Zoologica,' Stuttgart, xxiii. Heft. lix. pp. 106-158, 1910) also found it plentiful in this lake. Jenkin (*loc. cit.* 1934) draws attention to the differences between Welter's ("Die Cladocera Ostafrikas," in 'Deutsch Ost-Afrika,' iv. (9) pp. 1-12, 1897) and Daday's (1910) figures of the tail. Most of the specimens in the present collection agree with Weltner's drawing in having the dorsal edge of the tail almost straight, but there are a few specimens with a distinct indentation near the anus as figured by Daday. The comb and "ciliation" of the claws are as described by Miss Jenkin.

*Simocephalus* sp.

One badly damaged specimen of this genus was present in a sample from Lake Young collected by plankton dredge working among water-lilies.

*Ceriodaphnia cornuta* Sars.

Syn. *Ceriodaphnia rigaudi* Richard.

Daday (in Termés. Füzetek. xxi. Anhangsheft, pp. 24-68, 1898) was the first to suggest that *C. cornuta* Sars and *C. rigaudi* Richard are synonymous. There have been differences of opinion on the point ever since. The literature on this question is reviewed by Brehm (*loc. cit.*) and Jenkin (*loc. cit.*). Jenkin came to the conclusion that *cornuta* and *rigaudi* were distinct species and maintained that there are horned varieties of both species. She suggested that much of the controversy was due to workers overlooking a number of characters which she enumerates. *C. cornuta* "has sharply pointed fornices, a tapering tail with eight spines, and longer antennules with their setae inserted near the middle of their length"; and *C. rigaudi* has "The smooth fornix, the straight untapered tail with only six, or at most seven anal spines, the longer rostrum,

and shorter antennules with their seta nearer the extremity."

The present collection consisted of six specimens from Lake Young and one from Lake Rukwa. The specimen from Lake Rukwa had no horn, and had a bifid carapace point, characters usually associated with *cornuta*; but it agreed with Jenkin's diagnosis of *rigaudi*. All the specimens from Lake Young agreed with *rigaudi* in having the seta of the antennule near the middle, and in having only five or six anal spines on the tail. Only one of these specimens, however, had a smooth fornix, all the others having a distinct point on it, though this was often very small. Further, in two of them the tail was tapering as it should not have been for *rigaudi*.

Although there were only seven specimens, and none of them agreed in all respects with *C. cornuta* s. str., they showed such a gradation of relevant characters that I feel that the species cannot at present be separated. Fischer-Piette (in Proc. Linn. Soc. Lond. 150th sess. pp. 268-275, 1938) demonstrated that in some localities species of *Patella* may live together, but remain quite distinct; and yet in other localities the same species are completely intergraded. Such facts very clearly demonstrate the arbitrary nature of the limits that are set to species.

The carapace of none of the present specimens of *C. cornuta* was hairy.

*Distribution*.—East and South Africa, Palestine, India, East Indies, Australia, Japan, Brazil.

#### *Moina dubia* Guerne & Richard.

A number of specimens of this variable species were collected from Lake Rukwa. Length about  $720\mu$ . Semi-erect. Ratio of tail-length to head-length 0.72. Tail with about seven feathered setae and short hairs in rows which run more or less parallel to the edge.

*Distribution*.—Australia, Java, Germany, and Africa, widely distributed in Africa.

#### *Macrothrix chevreuxi* Guerne & Richard.

Only one specimen of this species was found, this was from Lake Young. The setae on the shell were rather

longer than those figured by Guerne & Richard (in *Mém. Soc. Zool. Fr.* v. pp. 526-538, 1892). The serrations on the ventral edge of the shell were in groups of three, and exactly as figured for the East African form of *M. chevreuxi* by Rùhe (Deutsche Süd-Polar. Exped. xvi. Zool. (8) pp. 4-66, 1914).

*Distribution.*—S. America and E. and S. Africa.

*Ilyocryptus spinifer* Herrick.

Syn. *I. halyi* Brady; *I. longiremus* Sars.

Only one specimen of this species was found. This was in a sample from Lake Young.

*Distribution.*—N. and S. America, East Africa, India, Ceylon, East Indies, Australia.

*Bosmina longirostris* (O. F. Müller).

Most of the samples from Lake Young contained this species. Most of the specimens belonged to var. *longirostris*, s. str. Lilljeborg.

*Distribution.*—Europe, E. and S. Africa, N. America, Japan.

*Bosminopsis deitersi* Richard.

Syn. *Bosminella anisetai* Daday.

A few specimens were found in a February sample from Lake Young; and a few young females and males were found in Lake Chila. As there were only a few specimens, and these were immature and not in a very good state of preservation, I have not attempted to decide to which of the varieties that have been described these specimens belong.

*Distribution.*—S. America, Louisiana, Poland, Russia, Japan, E. and Central Africa.

*Alona* sp.

Two specimens of *Alona* were found in L. Young which I have been unable with certainty to refer to a known species. In general appearance and shape of shell and tail they are very similar to *Alona quadrangularis* (Müller). They are, however, only 0.5 mm. long, and the scale-like groups of setæ on the sides of the tail are too well developed. Also the post-ventral corner of the lip plate is rounded.

*Alonella exigua* (Lilljeborg).

One specimen obtained among water-lilies in Lake Young. Length 310  $\mu$ . Reticulation of shell rather more difficult to see than in most European specimens.

*Distribution*.—Europe and N. America.

*Alonella punctata* Daday.

Two females were found in Lake Rukwa (Daday also found it here in 1910).

*Distribution*.—Ceylon, S. America, E. Africa.

*Chydorus* cf. *eurynotus* Sars.

Two imperfect specimens were found in Lake Young which belong to this group of *Chydorus*.

*Distribution*.—S. America, E. Africa.

*Paradiaptomus* (*Lovenula*) *africanus* (Daday).

This large species was present in large numbers in the plankton of Lake Rukwa. Daday (in *Zoologica*, Stuttgart, xxiii. Heft. 59, pp. 106–158, 1910) found this species in several E. African lakes including Lake Rukwa. Lowndes (in *Proc. Zool. Soc. Lond.* 1930, pp. 161–179, 1930) found it in plankton from Abyssinia, and gives an adequate description with figures as *P. biramata*, sp. n. Lowndes (in *Journ. Linn. Soc. Lond.*, Zool. xl. pp. 1–32, 1936) found further specimens in plankton from E. African lakes, and gives an even fuller description with further illustrations, this time as *P. africanus* with a note that *P. biramata* is a synonym.

*Distribution*.—East Africa and Abyssinia.

*Diaptomus* (*Tropodiaptomus*) *kræpelini* Poppe & Mrázek.

This was present in large numbers in plankton from Lake Rukwa, which is one of the lakes in which Daday (*loc. cit.*) found it. Lowndes (in *Proc. Zool. Soc. Lond.* 1930, pp. 161–179) gives a good description with figures of the specimens found in Abyssinia.

*Diaptomus* (*Tropodiaptomus*) *simplex* Sars.

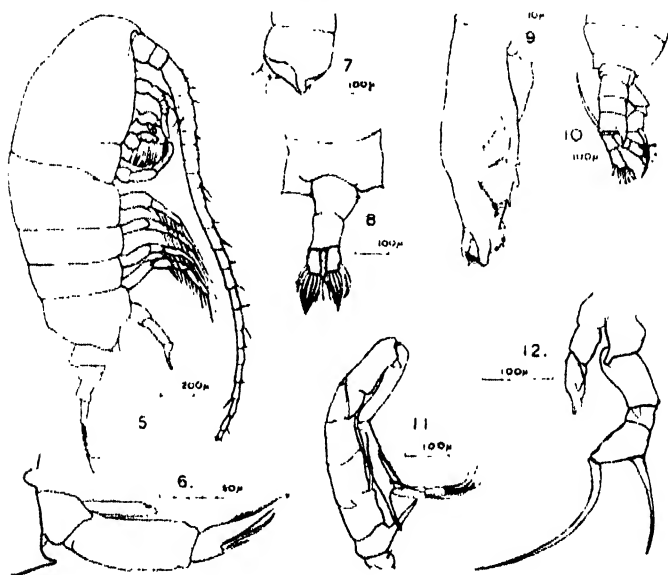
This species, which was described by Sars (in *Proc. Zool. Soc. Lond.* pp. 31–77, 1909) from Lake Tanganyika was present in samples from the same lake.

*Diaptomus (Thermodiaptomus) ricardox*, sp. n.

Types in British Museum (Natural History).

*Description of adult female* (figs. 5-8). Length 1050-1250  $\mu$ .*Thorax* more or less parallel-sided, from two and a half to three times as long as it is broad. Last two somites fused. Last somite expanded laterally into wing-like

Figs. 5-12.

*Diaptomus (Thermodiaptomus) ricardox*.

5. Adult female. 6. Leg 5, female. 7. Last thoracic somite, female from left. 8. Last thoracic somite and abdomen, female. 9. Leg 5, male, left. 10. Abdomen of male. 11. Prehensile antennule, male. 12. Leg 5, male.

processes, of which the left is a little larger than the right. Each process ends in a small spine. Rostrum well developed. *Abdomen* of two somites and a little inclined to the left. Both somites of about equal length. Genital somite about as long as it is broad, and with a small

spine on each side. *Furcal rami* fairly symmetrical, with fine hairs on the inside margin, and a fan of stiff feathered setæ. *Antennules* of twenty-five segments and reaching to the furcal rami. *First leg* with one outer spine on exopod 3. *Fifth leg* (fig. 6), inner ramus rather more than half the length of the first joint of the outer ramus, and ending with two minute spines, the medial of which is very difficult to see. Claw of outer ramus rather straight, and with a conspicuous comb of setules. Inner apical seta considerably shorter than the claw.

*Description of adult male* (figs. 9-12). Length 950-1070  $\mu$ .

*Thorax*.—Greatest width in region of somite of leg 1. Sides not parallel. Last segment not laterally expanded, but produced backwards slightly, and ending on each side with a minute, but sharply pointed spine which is directed outwards (fig. 10). *Abdomen* (fig. 10) of five somites, of which the last two are very asymmetrical. The penultimate segment has a backwardly projecting extension of its dorsal surface on the right which overlaps the anal segment. Anal segment bent sharply to the right. *Furcal rami* fairly symmetrical, but owing to the bending of the last abdominal somite are directed to the right. The furcal setæ are longer than in the female, and much more slender. *Prehensile right antenna* with a strong spine on segment 13. The process of the antepenultimate segment is as long as the penultimate segment (fig. 11). *Fifth legs* (figs. 9 & 12). *Right leg* rather large and conspicuous. Basal joint with the inner distal corner produced as a blunt process on the posterior side. Near the tip of this process is a small curved needle-like spine directed outwards. Inner ramus absent, or perhaps represented by a small projection from the anterior surface of the second basal joint. End joint of outer ramus of right leg with well-developed lateral spine and a long curved terminal claw. There are minute teeth on the inner curves of both spine and claw; but these are only visible under an oil immersion lens, and then only in suitable mounting media. No other spines or scale-like projections are present on the right leg. *Left leg*. Both rami (fig. 9) uniaarticulate. Outer ramus with inner edge in two convex serrated curves. Two short finger-like

processes at the tip, the outer one the more slender, and with a subterminal tuft of setules.

*Occurrence*.—The dominant animal and only *Diaptomus* in the plankton of Lake Young.

*Macrocylops albidus* (Jurine) var. *oligolasius* Keifer.

The variety *oligolasius* differs from *Macrocylops albidus* s. str. only in the complete absence of the distal seta on the median side of endopod 3 of leg 4. Kiefer's types (in Zool. Anz. lxxvi. pp. 5-18, 1928) were from S. Rhodesia; Sars (in Proc. Zool. Soc. Lond. 1909. pp. 31-77) had previously figured this form from L. Nyasa, and Harada (in Annot. zool. jap. xiii. pp. 149-168, 1931) also records it from Formosa. It was present in plankton collected from Lake Young.

*Tropocylops prasinus* Fischei, Schmeil  
var. *tenellus* Sars.

Lowndes (in Proc. Zool. Soc. Lond. 1930, pp. 161-179) described a form of *prasinus* from Abyssinia which lacked the seta on the basis of leg 1 (a most unusual feature in the Cyclopidae), and also had a spine formula 3.4.3.3 instead of the usual formula for this species 3.4.4.3. Kiefer (Zool. Anz. lxxxvii. pp. 118-124, 1930 & Zeitsch. wiss. Zool. cxxxviii. pp. 487-514, 1931) considered that *T. prasinus*, as then understood, could be divided into at least four species. He, however, did not take into account the presence or absence of the seta on the basis of the first leg; but based his classification on the spine formula, the size of the adult and proportionate measurements of leg 4 and its spine. Until we know in which forms the seta in question is lacking, Kiefer's classification must remain provisional; and I agree with Lowndes (in Ann. & Mag. Nat. Hist. ser. 10, x. pp. 45-80, 1932) and Gurney ("British Fresh Water Copepoda," iii. Ray. Soc. Publ. 1933), who prefer not to subdivide the species until we have more information. The specimens before me agree with Sars's description of *Cyclops tenellus*, and as Sars's types are in the British Museum I have been able to ascertain that they agree in the following details as well:—Length of adult female 380-390  $\mu$ . No seta on basis of first leg. Ratio of length of inner and outer spines of



endopod of fourth leg, 4.6 : 1. Last joint of this endopod three times as long as it is broad. Caudal rami a little longer than the anal segment. Inner corner seta and outer corner spine both about equal in length to the furca.

*Occurrence*.—Many specimens were collected from Lake Chila, which is near the type-locality, Lake Tanganyika. A few were also found in Lake Young.

*Eucyclops parvicornis*, sp. n. (Figs. 13–19.)

Types in British Museum (Natural History).

This and the following species are both very similar to *E. agilis*, but differ strikingly in the shortness of the first antenna. In *E. agilis* this usually reaches a little beyond the second thoracic somite. In neither of these species, however, does the antennule reach as far as the end of the cephalothorax.

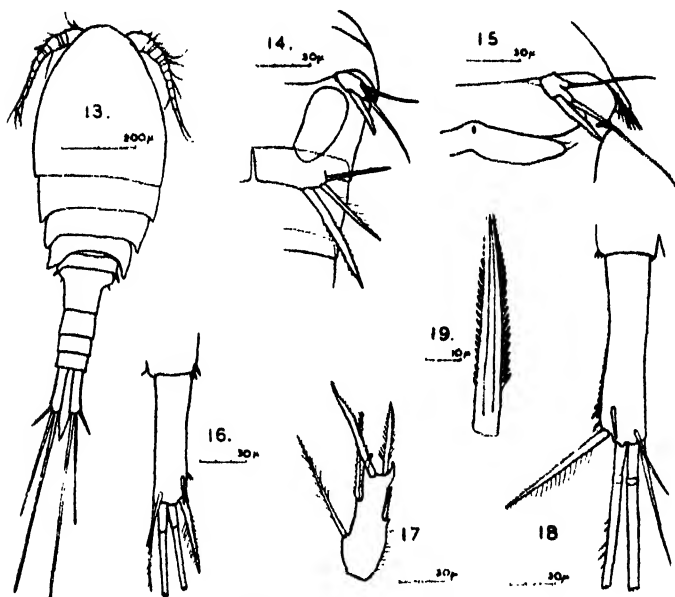
*Description of adult female* (fig. 13).—Length 1020–1060  $\mu$ . Lengths of thorax, abdomen and furcal rami 61 : 28 : 11.

*Body* (fig. 13) similar in shape to that of *E. agilis*. Fifth thoracic somite with a tuft of bristles on the pointed posterior corners. *Furcal rami* (fig. 18) about four and a half times as long as they are broad and slightly divergent. Outer margin with a longitudinal row of spines which become smaller and more ventrally situated anteriorly. Lateral seta near the end and inserted on the dorsal surface. Outer corner spine stout, with conspicuous denticles on the outer side and well feathered on the inside. Inner corner seta about equal in length to the outer corner spine and about two-thirds the length of the furcal rami. (In *E. agilis* the inner corner seta is a little longer as a rule than the outer corner spine.) Dorsal seta naked and about as long as the inner corner seta. Inner terminal seta about five-thirds the length of the outer terminal seta. *Antennule* of twelve segments about half as long in proportion to the body as that of *E. agilis*, reaching as it does only to about two-thirds the distance to the end of the cephalothorax. The hyaline membrane is extremely finely toothed. The lengths of the segments of the antennule have the same proportions to one another as in *E. agilis*; but each is very short in comparison with its length, and this partly accounts for the extreme

shortness of the whole antennule. *Second antenna* with the seta of segment 1 long enough for its last third to project beyond the tip of the appendage. Spine formula 3.4.4.3. I can find no difference between the swimming legs of this species and those of *E. agilis*. In both species the outer spines are coarsely denticulate (figs. 17 & 19). Fifth leg and receptaculum as illustrated (fig. 15).

*Description of male*.—Length 800–820  $\mu$ .

Figs. 13–19.



*Eucyclops parvicornis*.

13. Adult female. 14. Legs 5 and 6, male. 15. Leg 5 and receptaculum, female; 16. Furcal ramus, male. 17. Leg 4, endopod 3. 18. Furcal ramus, female. 19. Terminal spine, exopod leg 2.

*Furcal rami* (fig. 16) a little more than four times as long as broad, without lateral denticles, more or less parallel. Inner corner seta only a little longer than the outer corner spine. Outer corner spine feathered on both sides. Inner terminal seta nearly twice as long as outer. Spine of sixth leg longer than the two setae, and reaching well beyond the second abdominal somite (fig. 14). The

*antennule* of the male does not lend itself to accurate measurement; but by measuring the length of the piece between the two hinges in this species and in English specimens of *E. agilis* it is found that the prehensile antenna of *E. parvicornis* is about 12 per cent. shorter in proportion to the body size than is that of *E. agilis*.

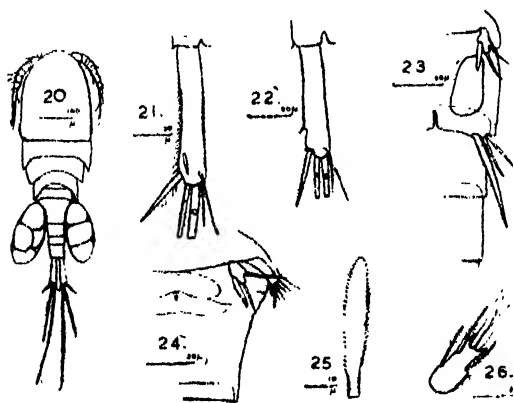
*Occurrence*.—About ten adult females, four with egg-sacs and five males were found in Lake Young samples collected by plankton-dredge.

*Eucyclops spatharum*, sp. n. (Figs. 20–26.)

Types in British Museum (Natural History).

Like the preceding species this is very similar to *E. agilis*, and differs from the latter most strikingly in the shortness of the antennule of the female. It is also considerably smaller in size.

Figs. 20–26.



*Eucyclops spatharum*.

20. Adult female. 21. Furcal ramus, female. 22. Furcal ramus, male.  
23. Legs 5 and 6, male. 24. Leg 5 and receptaculum, female.  
25. Terminal spine, exopod leg 2. 26. Leg 4, endopod 3.

*Female* (fig. 20).—Length 640–710  $\mu$ . Lengths of thorax, abdomen and furcal rami about in the proportions 61 : 26 : 13. *Furcal rami* (fig. 21) widest distally, a little over five times as long as the greatest width. Outer margins

with coarse denticles which are longest distally, and become more ventrally situated anteriorly. Lateral seta dorsally situated. Outer corner spine almost smooth on the outer side, and feathered on the inner. Inner corner seta distinctly shorter than the outer corner spine. Dorsal seta naked and longer than the inner corner seta. Outer terminal seta about half the length of the inner terminal seta. Antennule of twelve segments not reaching the hind edge of the cephalothorax. Spine formula 3.4.4.3. Proportionate lengths of spines and setæ and proportions of swimming legs identical, as far as I could determine, with those of *E. agilis* and *E. parvicornis*. The spines, however, particularly those of the exopod of leg 2 are very broad, with minutely serrated hyaline margins (fig. 25). Fifth leg and receptaculum seminis typical of the genus (fig. 24).

*Male*.—Length 660–690  $\mu$ . Furcal rami (fig. 22) about four and a half times as long as broad, without marginal denticles. Spines and setæ of furcal rami similar to those of the female. Outer spines of swimming legs spatulate as in the female. Leg 6 with long inner spine projecting well beyond the second abdominal somite (fig. 23).

*Remarks*.—This species is very similar to *E. parvicornis* just described, and like it differs from *E. agilis* most strikingly in the much greater shortness of the first antenna of the female. It is, however, easily distinguished from *E. parvicornis* by its considerably smaller size, by the comparative shortness of the inner corner seta, and by the smoothness of the outer edge of the outer corner spine of the furcal rami, and also by the broad, very finely serrated outer spines on the swimming feet. It is from this latter character that the specific name here proposed is derived (*E. spatha* a spatula) (compare figs. 19 & 25).

*Occurrence*.—Several specimens of both sexes were collected by plankton net or dredge from Lake Young. In two cases *E. spatharum* and *E. parvicornis* were found together in the same sample.

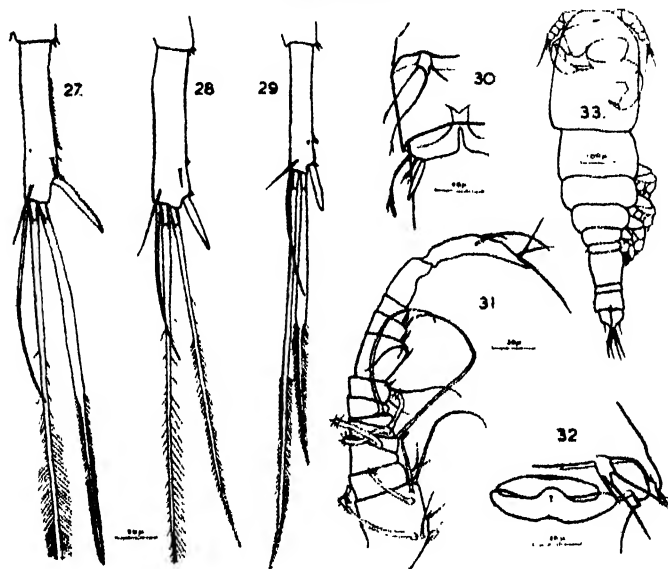
*Eucyclops euacanthus* (Sars). (Figs. 27–33.)

Sars's (in Proc. Zool. Soc. Lond. pp. 31–77, 1909) description of the female of this species has been supplemented by Kiefer (Faune Colon. franç. i. (6) pp. 535–570, 1927, & in Zool. Anz. lxxvi. pp. 5–18, 1928). The

receptaculum seminis is now figured for the first time (fig. 32). It is typical of the genus *Eucyclops*.

*Description of adult male*.—Apart from details of the genital armature and the sixth leg (Kiefer, 1927 & 1928) the male of this species has not previously been described, and as it shows an interesting resemblance to the immature female in the armature of its furca I am adding a brief description here. *Length* about 700  $\mu$ , i. e., a little less than that of the female.

Figs. 27–33.



*Eucyclops euacanthus* (Sars).

27. Furcal ramus, adult female. 28. Furcal ramus, immature female.  
29. Furcal ramus, male. 30. Legs 5 and 6, male. 31. Prehensile antennule, male. 32. Leg 5 and receptaculum, female.  
33. *Ergasiloides* cf. *brevimanus* Sars.

*Prehensile antennule* similar to that of *E. agilis* (fig. 31). *Furcal rami* (fig. 29) more or less parallel, without the lateral denticles found on the female except for a few spinules near the lateral seta. Outer corner spine smooth and, unlike that of the female, does not stand out. Outer terminal seta very broad and naked for rather more than half its length, and then where the feathering begins

it becomes suddenly narrow. The same condition is found in the female, though Sars does not mention it. *Legs* 1 to 4 as in the female including the broad lanceolate form of the terminal spines of both rami of the fourth leg. *Leg* 5 like that of the female with short inner spine which is very like a seta, and two slender setæ. *Leg* 6 with strong inner spine and two setæ, the inner of which is short with a terminal tuft of long setules (fig. 30).

There were several immature females in the last copepodid stage. The furcal rami of these (fig. 28) were like those of the male just described and had not yet developed the lateral denticles of the adult female, the outer corner spine was also less erect than in the adult female, and more like that of the male. One specimen was about to undergo the final moult to the adult form, and the lateral denticles were visible under the smooth cuticle of the furcal ramus. This observation substantiates the identification of these immature females and the adult males with this species. In this connection it is interesting to note that although both male and female have the unusual broadening of the basal part of the outer terminal seta (figs. 27 & 29) the immature females have a normal slender seta (fig. 28).

*Occurrence*.—Several specimens of both sexes were found in Lake Young. The species is known from E. and W. Africa.

*Eucyclops gibsoni* (Brady).

This well known African species was found in one of the samples from Lake Young.

*Distribution*.—E., W. and S. Africa and Palestine.

*Ectocyclops compactus* (Sars).

This species was described by Sars (Proc. Zool. Soc. Lond. 1909, pp. 31-37) from Lake Tanganyika. Two specimens were found in Lake Young. Neither of them carried egg-sacs (24. viii. 36).

*Microcyclops attenuatus* (Sars).

One female was found in Lake Tanganyika, which is the type-locality (Sars, *loc. cit.*).

*Mesocyclops leuckarti* (Claus).

This cosmopolitan species was found in the plankton of Lake Rukwa. Kiefer (in Zool. Anz. xc. pp. 86-92, 1930) gives a key to several subspecies of *M. leuckarti*; but as the present specimens were all immature (28. ix. 1936) it was unfortunately impossible to use this key.

*Mesocyclops neglectus* (Sars).

It is a matter of opinion whether *M. neglectus* is given specific rank or whether it is regarded as a variety of *M. hyalinus*. Gurney ("British Fresh Water Copepoda" iii. Ray Soc. Publ. 1933) shows that in *M. hyalinus* there is "considerable variation in all the characters which are regarded as specific." Lowndes (Journ. Linn. Soc. Lond., Zool. xl. pp. 1-32, 1936) considers that the separation of *neglectus* and other forms of this group is of no ecological importance. Kiefer (in Arch. Hydrobiol. Stuttgart, xxxii. pp. 470-485, 1937) has reviewed his subgenus *Thermocyclops* and of the several species there dealt with as distinct it is to the description of *M. neglectus* that the present specimens agree. Over fifty specimens were examined, and in the relative lengths of the furcal rami and their setæ, in the shape and armature of the uniting lamella of the fourth pair of legs, in the relative lengths of the spines of the endopod of the fourth leg, and in the shape of the receptaculum they agreed with *M. neglectus* and with no other form. It is therefore convenient to give *neglectus* specific rank in the present case.

*Occurrence*.—Found in nearly all the tow-net samples of plankton from Lake Young; but not in most of the samples from this lake collected with a plankton dredge. *M. neglectus* has been found in E. and S. Africa.

*Ergasiloides* cf. *brevimanus* Sars.

Sars (*loc. cit.*) described from immature free-swimming stages, three new species of parasitic Copepod from Lake Tanganyika and Lake Nyasa. He established the new genus *Ergasiloides* for them, and described them as having only two abdominal somites in the female and three in the male. Gurney (in Proc. Zool. Soc. Lond. 1928, pp. 317-332) found several specimens from Tanganyika

which he was able to refer with certainty to two of Sars's species, *E. megacheir* and *E. macrodactylus*, although these specimens had in all cases an additional abdominal somite. Sars's third species *E. brevimanus*, was distinguished from the other two by the robust shape of the prehensile second antenna, and by the bifurcation of the inner furcal seta, among other characters. Gurney suggested that *E. brevimanus* is a more immature stage of the life-history of *E. megacheir*, and pointed out that the possession of a forked furcal seta is a characteristic of the early stages of the Ergasilidæ. However, the single specimen collected from Lake Tanganyika by Miss Ricardo and Miss Owen, which is more like *brevimanus* than either of the other two, is considerably larger ( $920\ \mu$ ) than Sars's *E. megacheir* ( $620\ \mu$ ) or even than the specimen of Gurney's, which he describes as being strikingly larger than the others ( $830\ \mu$ ). It therefore can hardly be considered an immature form of this species, although it has the forked furcal seta. This large specimen may well belong to a new species; but until we know something of the adult forms of *Ergasiloides* it is best to refrain from describing more species. It may be a later stage in the development of *E. brevimanus*. It agrees with Sars's description and figures of this species in the following details: the prehensile antenna has the same general shape (fig. 33), and is much stouter than that of either of the other two species; the dorsal face of the head is not sculptured in the way described for the other two species, the furcal seta is bifurcated, and except for the exopod of the fourth leg the swimming legs have the same number of points. It differs, however, in the much larger size, in the much greater development of the second antenna, in the presence of three abdominal somites in the female, in the presence of six instead of five segments to the antennule, in the further development of the swimming legs (both the rami of all the swimming legs have two segments), and in the more rectangular shape of the head. All these differences are consistent with the idea that it is a later stage in the development of *E. brevimanus*.



XVIII. *Hymenoptera Aculeata captured in Southern Skåne, Sweden, in 1938.* By J. F. PERKINS, B.Sc., Department of Entomology, British Museum (Natural History).

THE following list of Aculeate Hymenoptera is based on the material collected in Southern Skåne by my wife and myself during our visit in 1938. The primary object of this trip was to collect Parasitic Hymenoptera and, in particular, Ichneumonidæ, and to determine as much as possible of the material of this family from the C. G. Thomson collection in Lund. In consequence, much of our collecting was done by sweeping, not a satisfactory method of collecting Aculeata, other than the Bethyloidæ and Dryinidæ, which are not included in this list. It is hoped that a separate list of these two families may later be published by Dr. O. W. Richards. However, such species as came our way were taken, and as the Parasitica were not in great evidence in the spring, more attention was paid to the spring bees than to the species appearing later in the season.

The list contains 189 species. Of these, I have been unable to find records from Sweden of the following nine species :—*Colletes floralis* Eversm. (= *montanus* Mor.), *Andrena apicata* Sm., *Halictus punctatissimus* Sch., *H. tarsatus* Sch., *H. viridi-æneus* Blüthg., *Sphecodes miniatus* v. Hag. (?= *geofrellus* K. Th., partim.), *S. fasciatus* v. Hag. (?= *geofrellus* K. Th., partim.), *Nomada opaca* Alfken, *Megachile versicolor* Sm.

The following 14 species have already been recorded from other parts of Sweden, but not from Skåne :—

*Colletes cunicularia* L., *Andrena ruficrus* Nyl., *A. lapponica* Zett., *Halictus 6-notatus* Nyl., *Trachusa serratulæ* Panz., (*Osmia*) *Acanthosmia montivaga* Mor. (= *mitis* Nyl. Th.), *Dolichurus corniculus* Spin., *Cemonus unicolor* ? var. *rugifer* Dahlb., *Diodontus dahlbomi* Mor., *Cœlocrabro cetratus* Shuck., *Tachysphex lativalvis* Th., *T. acrobatus* Kohl., *Dolichovespula media* Retz., and *Odynerus crassicornis* Panz.

The material, except in the cases indicated in the list, has been named by my father, Dr. R. C. L. Perkins, F.R.S., and the notes on the species are also by him.

Certain of the species required comparison with longer series than my father had at his disposal, and Dr. O. W. Richards kindly consented to examine these for me.

More precise details about the localities in which we collected can be found by reference to 'Opuscula Entomologica' (1939), pp. 120-123.

The names of species occurring in Britain are those used by Dr. O. W. Richards in his 'Check List of British Species of Aculeata,' published by the Royal Entomological Society of London (1937), except in those species where more recent revision and examination of types has caused further alteration of nomenclature (*e. g.*, in Vespidae and Eumenidae).

\* Not recorded by Thomson from Skåne.

† Not recorded by Thomson from Sweden.

### Prosopidae.

*Prosopis communis* Nyl., 1 ♀, Höör district, 26. vi. 38 ; 2 ♂, Kivik, 15 and 16. vii.

*Hylæus confusa* Nyl., 2 ♂, 1 ♀, Höör district, 26-28. vi. ; 2 ♂, Ö. Ring sjö, 7. vi. and 19. vi. ; 2 ♂, 1 ♀, Löderup, 24-26. vii. ; 2 ♂, Skäralid, 1. vii. and 3. vii. ; 1 ♀, Degaberga, 11. vii. ; 1 ♂, Kivik, 19. vii. *H. brevicornis* Nyl., 1 ♂, Höör district, 13. vi. ; 2 ♂, Löderup, 24. vii. *H. hyalinata* Smith (= *armillatus* Nyl.), 3 ♂. Degaberga, 12-14. vii.

### Colletidae.

*Colletes succincta* L., 1 ♂, Genarp, 4. viii. *C. fodiens* Geoff. (= *marginata* Sm., Th. nec Sm.), 1 ♂, Kivik district, 18. vii. *C. daviesana* Sm., 1 ♂, Löderup, 22. vii. † *C. floralis* Eversm. (= *montanus* Mor.), 1 ♂, Löderup, 22. vii. \* *C. cunicularia* L., 5 ♂, 8 ♀, Kranke sjö, 4. v.

### Andrenidae.

*Andrena hæmorrhoea* F. (= *albicans* auctt.), 19 ♂, 2 ♀, Genarp, 27. iv.-14. v. ; 3 ♂, 1 ♀, Yddinge sjö, 5. v. ; 9 ♂, Ö. Ring sjö, 30. iv. ; 1 ♀, Kranke sjö, 4. v. *A. carbonaria* L., 2 ♀, Löderup, 25 and 27. vii. *A. tibialis* K., 4 ♂, Genarp, 27. iv. and 2. v. ; 7 ♂, Ö. Ring sjö, 30. iv. ; 4 ♂, Kranke sjö, 4. v. ; 4 ♀, Yddinge sjö, 24. iv.-22. v. ; 1 ♀, Fjellfota sjö, 12. v. *A. morawitzi* Th., 3 ♂, 1 ♀,

Genarp, 27. iv.-2. v. ; 1 ♀, Kranke sjö, 4. v. *A. pectoralis* (Perez) Solnied. (= *vitrea* Sm. Th., nec Sm.), 1 ♀ worn, Degaberga, 14. vii. *A. cineraria* L., 1 ♂, Genarp, 2. v. ; 2 ♀, Dalby, 23. v. *A. nigroænea* K., 3 ♂, Ö. Ring sjö, 30. iv. ; 4 ♂, Höör district, 29. v.-2. vi. ; 1 ♂, Eslöv, 17. v. ; 5 ♂, Yddinge sjö, 22. v. ; 2 ♂, Dalby, 23. v. ; 1 ♂, Dagstorp sjö, 28. v. ; 1 ♀, Genarp, 14. v. *A. bicolor* F., 4 ♂, 1 ♀, Genarp, 27. iv.-2. v. ; 5 ♂, Kranke sjö, 4. v. ; 6 ♀, Yddinge sjö, 10. iv.-5. v. ; 2 ♀, Ö. Ring sjö, 30. iv. \**A. ruficrus* Nyl., 1 ♀, Eslöv, 17. v. *A. jacobii* Perk, (= *trimmerana* auctt.), 8 ♂, 2 ♀, Ö. Ring sjö, 30. iv. ; 1 ♀, Dalby, 13. v. ; 1 ♀, Genarp, 14. v. *A. clarkella* K., 1 ♂, 1 ♀, Yddinge sjö, 10. iv. ; 5 ♀, Ö. Ring sjö, 30. iv. ; 1 ♀, Genarp, 2. v. ; 1 ♀, Fjellfota sjö, 12. v. ; 1 ♀, Kranke sjö, 4. v. †*A. apicata* Sm., 3 ♀, Ö. Ring sjö, 30. iv. ; 1 ♀, Kranke sjö, 4. v. *A. præcox* Scop. (= *helvola* L. Th., nec L.), Genarp, Ö. Ring sjö, Kranke sjö, Dalby, Yddinge sjö, 26 ♂, 47 ♀, 12. iv.-15. v. *A. varians* Rossi, 1 ♀, Yddinge sjö, 3. v. *A. helvola* L., 8 ♂, Dalby, 11. v. and 23. v. ; 1 ♂, Eslöv, 17. v. ; 1 ♂, Yddinge sjö, v. \**A. lapponica* Zett., 1 ♂, 5 ♀, Höör district, 27. v.-17. vi. ; 1 ♀, Fjellfota sjö, 12. v. *A. fucata* Sm., 2 ♂, 2 ♀, Höör district, 16. vi. and 22. vi. ; 1 ♀, Eslöv, 17. v. ; 1 ♂, Yddinge sjö, 22. v. ; 1 ♀, Degaberga, 8. vii. ; 1 ♀, Skärallid, 3. vii. *A. denticulata* K. (= *listerella* K.), 1 large ♂, var. with thorax above almost entirely black-haired, except the propodeum, Kivik, 15. vii. *A. barbilabris* K. (= *sericea* Chr.) 9 ♂, 4 ♀, Genarp, 27. iv.-14. v. ; 2 ♂ (one styloipised †), 2 ♀, Kranke sjö, 4. v. ; 1 ♂, Degaberga, 12. vii. *A. wilkella* K. (= *convexiuscula* K. Th.), 1 ♂, Degaberga, 10. vii. ; 1 ♂ (styloipised §), Höör district, 17. v. *A. lathyri* Alf. (= *xanthura* K. Th., nec K.), 2 ♂, 1 ♀, Höör district, 27. v. and 1. vi. ; 1 ♂, 3 ♀, Eslöv, 17. v. ; 1 ♀, Dalby, 23. v. *A. ovatula* K. (= ? *albofasciata* Th.), 1 ♂, Genarp, 14. v. ; 1 ♂, Kranke sjö, 4. v. *A. subopaca* Nyl., 5 ♂, 1 ♀, Höör district, 3. vi.-28. vi. ; 3 ♂, Yddinge sjö, 22. v. ; 1 ♂, Eslöv, 17. v. ; 1 ♀, Degaberga, 10. vii. (several are styloipised ||). *A. minutula* K., 1 ♂, 8 ♀, Ö.

† *Stylops dahlui* Curtis has been recorded from this species in Britain.

§ *Stylops wilkella* Perkins has been recorded from this species in Britain.

|| *Stylops spreta* Perkins has been recorded from this species in Britain.

Ring sjö, 30. iv. ; 3 ♀, Genarp, 27. iv.-2. v. ; 1 ♀, Kranke sjö, 4. v. ; 1 ♀, Yddinge sjö, 5. v. ; second generation, 1 ♂, Degaberga, 12. vii. *A. tarsata* Nyl. (= *analis* auctt.), 1 ♂, Degaberga, 11. vii. *A. hattorfiana* F., 1 ♂, 1 ♀, Degaberga, 13 and 14. vii.

*Melitta (Cilissa) hæmorrhoidalis* F., 3 ♂, Degaberga, 10-12. vii. ; 1 ♂, Kivik, 16. vii. ; 1 ♂, Genarp, 4. viii. ; 1 ♀, Löderup, 27. vii. The ♀ is near var. *nigra* Friese. *M. leporina* Panz., 1 ♂, Degaberga, 12. vii.

*Dasygaster argentata* Panz. (= *plumipes* Nyl.), 1 ♂, Kivik district, 19. vii.

*Halictus rubicundus* Chr., 4 ♀, (Genarp, Höör district, Dalby, 2. v.-16. vi. *H. villosulus* K. (= *punctulatus* K. Th.), 1 ♀, Degaberga, 12. vii. \**H. 6-notatus* Nyl., 1 ♀, Ö. Ring sjö, 30. iv. *H. lativentris* Sch. (probably = *4-notatus* Nyl. Th.), 1 ♀, Yddinge sjö, 5. v. *H. caceleatus* Scop. (= *cylindricus* F.), 2 ♀, Ö. Ring sjö, 30. iv. ; 2 ♀, Höör district, 29. v. and 2. vi. ; 1 ♀, Dalby, 13. v. ; 1 ♀, Yddinge sjö, 5. v. †*H. punctatissimus* Sch., 2 ♀, Genarp, 27 and 28. iv. ; 1 ♀, Yddinge sjö, 18. iv. †*H. tarsatus* Sch., 11 ♀, Genarp, 27 and 28. iv. and 14. v. ; 1 ♂, 4. viii., may belong to these females. *H. rufitarsis* Zett. (= *minutus* K. Th., nec K. partim), 1 ♀, Yddinge sjö, 22. v. *H. perkinsi* Blüthg., 5 ♀, Genarp, 27. iv.-14. v., and 1 ♂, 4. viii. ; 1 ♀, Kranke sjö, 4. v. ; 1 ♂, Degaberga, 12. vii. *H. morio* F., 5 ♀, Genarp, 28. iv. and 2. v., and 1 ♂, 4. viii. ; 1 ♂, Degaberga, 9. vii. ; 1 ♀, Kivik, 15. vii. *H. leucopus* K., 2 ♀, Genarp, 2. v. ; 2 ♀, Degaberga, 12 and 14. vii. ; 1 ♀, Löderup, 22. vii. ; 1 ♂, Kivik, 15. vii. †*H. viridi-æneus* Blüthg., 1 ♀, Genarp, 28. iv.

*Dufourea halictula* Nyl., 8 examples, Degaberga, 10-13. vii.

*Sphecodes reticulatus* Th., 1 ♀, Höör district, 18. vi. *S. pellucidus* Sm. (= *pilifrons* Th.), 2 ♂, Genarp, 4. viii. ; 1 ♀, Ö. Ring sjö, 30. iv. ; 1 ♀, Löderup, 23. vii., very worn specimen after hibernation. †*S. miniatus* v. Hag. (= *dimidiatus* v. Hag.) (? = *geofrellus* K. Th. partim), 2 ♂, Genarp, 4. viii., and 3 ♀, 28. iv. and 2. v. ; 1 ♀, Löderup, 23. vii. ; 1 ♀, Kranke sjö, 4. v. *S. crassus* Th. (= *variegatus* v. Hag.), 1 ♀, Genarp, 2. v., and 1 ♀ (small and rather doubtful), 29. iv. †*S. fasciatus* v. Hag. (? = *geofrellus* K. Th. partim), 1 ♀, Ö. Ring sjö, 30. iv.

*Halictoides inermis* Nyl., 1 ♂, Genarp, 4. viii.

*Panurgus banksianus* K. (= *ursinus* auctt.), 4 ♂, Höör district, 26. vi.; 1 ♂, Degaberga, 9. vii.; 1 ♂, Kivik, 19. vii. *P. calcaratus* Scop., 3 ♂, 1 ♀, Degaberga, 13. vii.

*Nomada goodeniana* K. (= *succincta* Pz. Th.), 1 ♂, Yddinge sjö, 5. v.; 1 ♂, Dalby, 23. v.; 1 ♀, Höör district, 31. v. *N. lathburiana* K. (= *rufiventris* K. Th.), 1 ♀, Genarp, 14. v. *N. lineola* Panz. (= *subcornuta* K. and *cornigera* K.), 10 ♂, Dalby, 13. v.; 2 ♂, 4 ♀, Genarp, 27. iv.-14. v.; 1 ♀, Höör district, 15. v.; 1 ♂, Yddinge sjö, v. All the ♀♀ are of the form with the flagellum entirely pale, the apical joints not being at all infuscated, except one, the earliest caught specimen, from Genarp. The ♀♀ with wholly pale flagellum are generally associated with *Andrena tibialis* in England, those with some joints infuscate with other species of the *tibialis* group. *N. panzeri* Lep. (= *ruficornis* auctt.), 2 ♂, 2 ♀, Dalby, 23. v.; 10 ♀, 1 ♂, Höör district, 29. v.-14. vi.; 1 ♀, Skärälid, 3. vii. The ♂ from Höör district and the ♀ from Skärälid are very dark specimens and may be referable to *glabella* Th., which Schmiedeknecht considered a variety of *panzeri*. *N. leucophthalma* K. (= *borealis* auctt.), 2 ♀, Yddinge sjö, 10. iv.; 1 ♂, Kranke sjö, 4. v., very bleached and with the ends of the wings much frayed or torn, appears to belong to this species, the ♂♂ of which are frequently on the wing during the last week of February and first week of March here in Devon. *N. ochrostoma* K. (= *hillana* K.) (= *punctiscuta* Th.), 1 ♀, Skärälid, 3. vii.; 1 ♀, Röstånga, 5. vii.; 1 ♀, Kivik, 20. vii. † *N. opaca* Alfken, 1 ♂, 1 ♀, Höör district, 9. vi. Will not do for Thomson's *villosa* as defined by Stöckhert. *N. ruficornis* L. (= *bifida* Th.), 6 ♂, Ö. Ring sjö, 30. iv.; 2 ♂, Dalby, 13. v.; 1 ♂, Fjellfota sjö, 12. v.; 6 ♀, Höör district, 27. v.-8. vi.; 2 ♀, Eslöv, 17. v.; 1 ♂, Yddinge sjö, v. *N. fabriciana* L., 1 ♂, 1 ♀, Genarp, 27. iv. and 2. v. The ♀ has the flagellum with the basal joints only obscurely red beneath, instead of being widely red-banded, as is usual in British specimens. I have similar examples with dark antennæ from Baden. *N. flavoguttata* K. (= *minuta* F. Th.), 10 ♂, 10 ♀, Höör district, 29. v.-22. vi.; 1 ♂, Ö. Ring sjö, 30. iv., and 1 ♀, 7. vi.; 1 ♀, Degaberga, 10. vii.; 1 ♂, Röstånga, 5. vii.; 1 ♂, Dalby, 23. v. *N. fuscicornis* Nyl., 1 ♂, Kivik, 18. vii., and 1 ♀, 19. vii. *N. germanica* Panz. (= *ferruginata*

auctt.); one old ♀, Degaberga, 8. vii. *N. rufipes* F. (= *solidaginis* auctt.), 1 ♀, Genarp, 4. viii.

*Eucera longicornis* L., 4 ♂, 1 ♀, Höör district, 2. vi. and 10. vi.; 2 ♂, Dagstorp sjö, 28. v.

\**Trachusa serratulæ* Panz., 1 ♂, Degaberga, 10. vii.

*Anthidium punctatum* var. C. Th., 1 ♀, Degaberga, 9. vii.

*Chelostoma nigricornis* Nyl., 3 ♀, Degaberga, 7–13. vii. *C. campanularum* K., 1 ♂, Kivik, 16. vii.

\*(*Osmia*) *Acanthosmia montivaga* Mor. (= *mitis* Nyl. Th.), 1 ♂, Degaberga, 13. vii.

*Osmia inermis* Zett., 1 ♂, Höör district, 31. v. *O. angustula* Zett. (= *parietina* Curt.), 1 ♂, Höör district, 17. vi. *O. ventralis* Panz. (= *leaiana* K.), 1 ♂, Höör district, 14. vi.; 1 ♂, Eslöv, 17. v. (O. W. Richards det.). *O. pilicornis* Sm., 1 ♀, Höör district, vi.

*Megachile lagopoda* L., 1 ♂, Löderup, 27. vii. *M. willughbiella* K., 1 ♀, Kivik, 15. vii. † *M. versicolor* Sm., 1 ♂, Degaberga, 12. vii.; 1 ♀, Höör district, 16. vi. *M. argentata* F., 1 ♀, Löderup, 23. vii. (O. W. Richards det.).

*Cœlioxyys inermis* K. (= *acuminata* Nyl.), 1 ♂, Löderup, 24. vii.

*Bombus distinguendus* Mor., 1 ♀, Dalby, 11. v.

### Sphegidae.

*Ammophila sabulosa* L., Löderup, 24. vii., a male and a female in cop. *A. (Miscus) campestris* Latr., 3 ♂, 2 ♀, Löderup, 22. vii.; 1 ♀, Degaberga, 12. vii.

*Podalonia* (= *Psammophila*) *viatica* L. (= *hirsuta* Scop.), 1 ♂, very worn, Kivik district, 18. vii. *P. affinis* K. (= *lutaria* auctt.), 1 ♀, Kivik district, 12. vii.

### Ampulicidae.

\* *Dolichurus corniculus* Spin., 1 ♂, Kivik, 15. vii.

### Pemphredonidae.

*Mimesa equestris* F., 7 ♂, Degaberga, 10–14. vii.; 1 ♀, Kivik, 19. vii. *M. shuckardi* Wesm. var., 1 ♂, Kivik, 15. vii. (O. W. Richards det.).

*Psenus (Psene) atratus* F., 1 ♀, Höör district, 8. vi.; 1 ♀, Degaberga, 13. vii.

*Pemphredon lugubris* F., 2 ♂, Höör district, 29. v. ; 1 ♀, Skärålid, 3. vii.

*Cemonus shuckardi* Mor. (= *unicolor* Latr. Th., *neo* Latr.), 3 ♂, Höör district, 1. vi. and 16. vi. ; 1 ♀, Löderup, 26. vii. ; 1 ex, Degaberga, 12. vii. \* *C. unicolor* ? var. *rugifer* Dahlb., 1 ♂, Degaberga, 12. vii.

\* *Diodontus dahlbomi* Mor., 1 ♀, Höör district, 26. vi.

*Passalæcus gracilis* Curt. (= *tenuis* Mor.), 1 ♀, Höör district, 22. vi. ; 1 ♀, Degaberga, 16. vii. ; 4 ♀, Kivik, 15 and 16. vii. *P. monilicornis* Dahlb., 1 ♂, 3 ♀, Kivik, 15–19. vii. *P. corniger* Shuck., 1 ♀, Kivik, 16. vii. *P. turionum* Dahlb. Th. (= *borealis* Dahlb.), 1 ♂, Höör district, 16. vi.

*Spilomena troglodytes* v. d. Lind., 1 ♀, Kivik, 15. vii.

*Stigmus solskyi* Mor., 7 ex., Kivik, 15 and 16. vii. ; 1 ex., Löderup, 27. vii.

#### Crabronidæ.

*Olytchrysus chrysostomus* Lep., 1 ♂, Höör district, 28. vi.

*Solenius continuus* F. (= *vagus* auctt.), 1 ♂, Löderup, 26. vii. ; 1 ♀, Höör district, 9. vi.

*Ceratocolus subterraneus* F., 6 ♂, 2 ♀, Degaberga, 12–14. vii. ; 1 ♂, 1 ♀, Löderup, 22. vii. One pair was taken in cop. and one female with its prey, a *Crambus*.

*Crabro* (= *Thyreopus*) *cribrarius* L., 2 ♂, 4 ♀, Löderup, 24–27. vii. ; 1 ♂, Degaberga, 13. vii. *C. peltarius* Schreb., 1 ♂, Degaberga, 11. vii. *C. scutellatus* Schev., 1 ♂, Ring sjö, 24. vi.

*Blepharipus dimidiatus* F. (= *serripes* Panz.), 1 ♂, Höör district, 28. vi. ; 1 ♂, Röstånga, 6. vii. ; 1 ♂, Kivik, 16. vii. *B. confusus* Schulz (= *signatus* Panz.), 1 ♀, Ring sjö, 27. vi. ; 1 ♀, Röstånga, 5. vii.

*Acanthocrabro vagabundus* Panz., 1 ♂, Ring sjö, 24. vi.

*Hoplocrabro 4-maculatus* F., 1 ♀, Kivik, 15. vii.

*Cælocrabro leucostomoides* Rich. (= *leucostoma* auctt.), 1 ♂, 1 ♀, Höör district, 29. v. and 12. vi. ; 1 ♀, Dagstorp sjö, 28. v. \* *C. cetratus* Shuck., 1 ♂, Dalby, 23. v. ; 1 ♂, Höör district, 1. vi. *C. pubescens* Shuck., 1 ♂, Löderup, 24. vii. ; 1 ♂, Dalby, 23. v. The latter is the var. *inermis* Th.

*Grossocerus palmipes* L. (= *palmarius* Schreb.), 2 ♂, Genarp, 4. viii. *C. tarsatus* Schuck. (= *palmipes* auctt.),

1 ♀, Dalby, 23. v. (var. with the basal areas of the propodeum nearly as smooth as in *anxius*); 1 ♀, Genarp, 4. viii. *C. wesmæli* v. d. Lind., 1 ♀, Genarp, 4. viii.; 1 ♀, Löderup, 24. vii.; 12 ex., 22. vii.; 1 ex., 27. vii.

*Lindenius albilabris* F., 2 ♀, 1 ♂, and 13 other ex., Degaberga, 11–13. vii.; 1 ex., Kivik, 16. vii.

*Corynopus coarctatus* Scop. (= *tibiale* F.), 1 ♂, 3 ♀, Kivik district, 18. vii.; 1 ♂, Höör district, 14. vi.; 1 ♂, Ring sjö, 7. vi.

*Rhopalum clavipes* L., 1 ♂, Röstånga, 6. vii.; 1 ♂, Kivik, 16. vii.; 1 ♂, Löderup, 27. vii.

*Entomognathus brevis* v. d. Lind., 2 ex., Kivik 16. vii.; 1 ex., Degaberga, 12. vii.

### Oxybelidæ.

*Oxybelus argentatus* Curt. (= *aculeatus* Th.), 1 ♀, Genarp, 4. viii.; 1 ♂, 1 ♀, Löderup, 22. vii.; 1 ♂, Degaberga, 12. vii. *O. sericatus* Gerst., 1 ♂, Löderup, 22. vii.

### Nyssonidæ.

*Gorytes mystaceus* L., 3 ♂, 1 ♀. Höör district, 31. v.–28. vi.; 1 ♂, 5 ♀, Skärålid, 3. vii.

*Hoplisis 4-fasciatus* F., 1 ♂, Löderup, 27. vii.

*Harpactus tumidus* Panz., 1 ♂, Löderup, vii.

*Nysson spinosus* Forst., 15 ex., Höör district, 29. v.–28. vi.; 2 ♂, Skärålid, 1 and 3. vii.; 1 ♂, Ring sjö, 12. vi. *N. interruptus* F. (= *shuckardi* Wesm. Th.), 1 ♀, Degaberga, 14. vii. *N. dimidiatus* Jur., 1 ♀, Degaberga, 14. vii.

### Mellinidæ.

*Mellinus arvensis* L., 3 ♂, Löderup, 22. vii.; 10 ♂, Genarp, 4. viii. *M. sabulosus* F., 1 ♂, Genarp, 4. viii.

### Trypoxylonidæ.

*Trypoxylon figulus* L., 4 ♂, Höör district, 8–28. vi.; 1 ♀, Löderup, 22. vii. *T. clavicercum* Lep., 2 ♀, Kivik, 15. vii.

### Philanthidæ.

*Philanthus triangulum* F., 1 ♂, 2 ♀, Kivik, 17 and 18. vii.



*Cerceris rybyensis* L. (= *ornatus* F.), 2 ♂, 1 ♀, Degaberga, 11 and 12. vii.; 1 ♀, Genarp, 4. viii. *C. arenaria* L., 4 ♂, Degaberga, 8-13. vii. *C. cunicularia* Schr. (= *labiata* F.), 1 ♂, Degaberga, 12. vii. *C. 5-fasciata* Panz., 2 ♂, 1 ♀, Degaberga, 12-14. vii. *C. 4-fasciata* Panz. (= *truncatula* Th.), 1 ♂, Höör district, 21. vi.; 1 ♂, Degaberga, 8. vii.

### Bembecidæ.

*Bembex rostrata* L., 2 ♂, 2 ♀, Kivik, 17 and 18. vii.

### Larridæ.

*Tachysphex pompiliiformis* Panz. (= *pectinipes* Blüthg.), 1 ♀, very old with frayed wings, Löderup, 22. vii.; 1 ♂, Höör district, 18. vi.; 1 ♂, Ring sjö, 7. vi. (♂♂ det. by O. W. Richards.) \**T. lativalvis* Th., 1 ♀, Degaberga, 12. vii.; 1 ♀, Löderup, 24. vii.; 1 ♂, 27. vii. \**T. acrobatus* Kohl., 1 ♂, Löderup, 23. vii.

### Astatidæ.

*Astata stigma* Klug, 1 ♀, Kivik, 18. vii.; 1 ♂, Löderup, 22. vii.

### Pompilidæ.

*Pompilus plumbeus* F., 1 ♂ (very small), Löderup, 24. vii.; 1 ♀, Kivik, 17. vii. *P. ? trivialis* Dahlb. (= *gibbus* F.), 1 ♀, Kivik, 20. vii. (possibly this specimen may be *unguicularis* Th.) *P. campestris* group, 1 ex, Löderup, 24. vii. *P. spissus* Sch., 2 ♀, Löderup, 24 and 27. vii.; 2 ♂, 1 ♀, Degaberga, 8-12. vii.; 2 ♂, Ring sjö, 24 and 27. vi. *P. aculeatus* Th., 1 ♀, Löderup, 26. vii. *P. cinctellus* v. d. Lind, 1 ♂, Degaberga, 12. vii.

*Anoplius fuscus* L. (= *viaticus* auctt.), 11 ♀, Yddinge sjö, 18. iv.; 1 ♀, Löderup, 26. vii.; 1 ♀, Genarp, 28. iv. *A. nigerrimus* Scop. (= *niger* F. Th.), 3 ♂, Skärålid, 3. vii.; 1 ♂, Höör district, 9. vi.; 1 ♀, Fjellfota sjö, 31. vii.

*Episyron rufipes* L., 3 ♂, Löderup, 22-24. vii.

*Priocnemis perturbator* Harr. (= *fuscus* auctt.), 1 ♂, 2 ♀, Dalby, 13. v.; 1 ♂, Yddinge sjö, v.; 1 ♀, Höör district, 31. v.; 1 ♀, Röstånga, 6. vii.

*Calicurgus hyalinatus* F. (= *fasciatellus* Spin. Th.), 1 ♂, Ring sjö, 27. vi.

*Deuterationia hircana* F., 1 ♀, Kivik, 20. vii.

*Ceropales maculata* F., 1 ♀, Ring sjö, 19. vi.; 1 ♂, Löderup, 27. vii.

#### Mutillidæ.

*Smicromyrme rufipes* F., 1 ♀, Löderup, 24. vii.

#### Myrmosidæ.

*Myrmosa atra* Panz. (= *melanocephala* F.), 2 ♂, Kivik, 15 and 20. vii.; 1 ♂, Löderup, 26. vii.; 1 ♀, Degaberga, 8. vii.

#### Methocidæ.

*Methoca ichneumonides* Latr., 1 ♀, Löderup, 22. vii.

#### Tiphidæ.

*Tiphia femorata* F., 3 ♂, 10 ♀, Löderup, 23–27. vii.; 5 ♀, Genarp, 4. viii.

#### Vespidæ.

\**Dolichovespula media* Retz., 1 ♀, Höör district, 31. v. *D. silvestris* Scop. (= *holsatica* F. Th.), 2 ♀, Yddinge sjö, 5. v.

*Paravespula vulgaris* L., 1 ♀, Höör district, 16. vi.; 1 ♀, Röstånga, 30. vi. *P. germanica* F., 2 ♀, Höör district, 2 and 21. vi. *P. rufa* L., 1 ♀, Höör district, 16. vi.; 1 ♀, 28. vi.; 1 ♀, Fjellfota sjö, 12. v.; 1 ♀, Yddinge sjö, 5. v.

#### Eumenidæ.

*Odynerus murarius* L., 1 ♂, Höör district, 28. vi. \**O. crassicornis* Panz. var., 1 ♂, Skärålid, 1. vii. *O. bifasciatus* Th. (?= *allobrogus* Sauss.), 1 ♂, Dagstorp sjö, 28. v. *O. gracilis* Br. (= *elegans* Wesm.), 1 ♂, Ring sjö, 12. vi.

*Ancistrocerus antilope* Panz., 1 ♀, Höör district, 5. vi. *A. parietinus* L., 1 ♂, Höör district, 29. v.; 1 ♀, Kivik, 16. vii. *A. oviventris* Wesm. (= *pictus* auctt., nec Curt.), 1 ♂, Höör district, 16. vi. *A. trifasciatus* Müll., 1 ♂, Höör district, 21. vi.; 1 ♀, 26. vi.; 1 ♂, Dalby, 23. v.

*Euodynerus 4-fasciatus* F. (= *tomentosus* Th.), 1 ♂, Höör district, 16. vi.

*Hoplomerus spinipes* L., 1 ♂, Skärålid, 3. vii.

*Eumenes coarctata* L., 1 ♀, Skärålid, 3. vii. *E. pedunculatus* Panz. (= *atricornis* F. Th., nec F.), 1 ♂, Löderup, 27. vii.; 1 ♀, Skärålid, 3. vii.

**Chrysididæ.**

*Chrysis ignita* L., one specimen, very small, Höör district, 28. vi. *C. succincta* L. var. *bicolor* Lep., 1 ex., Kivik, 16. vii. *C. scutellaris* F., 2 ex., Löderup, 23 and 25. vii.

*Notozus constrictus* Först., 16 ex., Degaberga, 8–12. vii.; 1 ex., Kivik, 19. vii.

*Hedychridium ardens* Coq., 4 ex., Löderup, 22 and 24. vii.

**Cleptidæ.**

*Cleptes nitidulus* F., 2 ex., Löderup, 22 and 24. vii.

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XIX.—The "*Pulex*" forms of *Daphnia* and their Separation into Two Distinct Series, represented by *D. pulex* (De Geer) and *D. obtusa* Kurz. By D. J. SCOURFIELD, I.S.O., F.L.S., F.R.M.S.

**INTRODUCTION.**

IN most recent works dealing with the Cladocera many of the forms of *Daphnia* to which specific names were given during the second half of last century have been again united under either *D. pulex* or *D. longispina*. Even these two have been held by some writers not to be specifically distinct, although this is not a generally accepted opinion and may certainly be regarded as incorrect. The change of view about the specific validity of the forms in question is due of course to the fact that most of the characters upon which the supposed species were based, such as shape of head, length and position of shell-spine, etc., have been found to be extremely variable and therefore unreliable. Nevertheless, this lumping together of so many forms is far from satisfactory either from the purely systematic or the practical ecological point of view, especially as one cannot help feeling that some of the forms are at any rate much more closely related to one another than to certain others, and that reliable distinguishing morphological characters probably

do exist in spite of the failure hitherto to be certain about them.

With regard to the many forms which have been reunited under *D. pulex* \*, there is indeed one which, more often than any of the others, has been considered as having some claim to independent specific rank or at any rate as being a good variety worthy of a distinctive name. This is *D. obtusa* Kurz. But there has been no general agreement as to the value of the characters by which it was supposed to be differentiated from *D. pulex*. It is true that four of these characters have been cited more frequently than any others, and thus give the nearest approach to an accepted definition of the form that has hitherto been made. These are (1) absence, or practical absence, of a shell-spine in the adult female; (2) antennules of females situated on a distinct hump; (3) post-abdomen of male without a well-marked bay in the middle; (4) abdominal processes of male only slightly or moderately developed. Now while these characters, when taken together, serve very well to distinguish the typical *obtusa* from the typical *pulex*, not one of them, with the possible exception of the apparently insignificant number two, can be relied upon to separate all forms of *D. obtusa* from all forms of *D. pulex*. It is not surprising, therefore, that the specific distinctness of *D. obtusa* should so far have been open to doubt.

#### A NEW AND FUNDAMENTAL DISTINCTION BETWEEN *D. PULEX* AND *D. OBTUSA*.

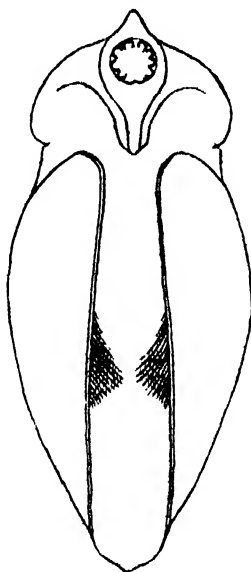
A few years ago I noticed that some specimens of *D. obtusa*, recognised as such by the hump bearing the antennules and the practical absence of a shell-spine, possessed another structure which I had not seen referred to in any work dealing with the "*pulex*" forms of *Daphnia*, namely, a row of long plumose setæ on the inner lip of the ventral margin of the valves, slightly anterior to the middle of its length. This observation led to a re-examination of all available forms of *Daphnia*,

\* The peculiar American pelagic species *D. retrocurva* Forbes and *D. breviceps* Birge, although referred to by Woltereck (see Woltereck, R., 1932) as the *parapulex* series of *D. pulex*, have not, for the purposes of this paper, been regarded as belonging to that species. They seem to require further investigation before being admitted as forms of *D. pulex*.

with the result that the possession or non-possession of these setæ has been found to be absolutely critical as between the *obtusa* and all other forms commonly included nowadays under the name of *D. pulex*.

Similar setæ are to be found, however, in the females of the following species of *Daphnia*:—*magna* Straus, *carinata* King, *atkinson* Baird, *thomsoni* Sars, *triquetra* Sars, *psittacea* Baird\* and *barbata* Weltner†. They also

Fig. 1.



Front view of *D. obtusa*, showing the long plumose setæ arising from near the middle of the inner lip.  $\times 40$ .

occur in *Daphniopsis* and *Ceriodaphnia*. In addition to *D. pulex*, such setæ do not occur in *Daphnia lumholtzi* Sars nor in any of the *Daphnia longispina-hyalina-cucullata* forms. Neither do they occur in *Moina*. In *Simocephalus* a row of longish setæ of a slightly different type extends practically the whole length of the inner lip of the ventral margin.

\* See T. Wolski, 1932.

† See J. Ooissaynska-Wolska, 1935.

In the living animals as usually seen, *i. e.*, viewed from the side, the setæ in question are not very noticeable as they do not normally project beyond the valves, and even when some of them occasionally do so they are apt to be mistaken for setæ belonging to the feet. If a front view can be obtained, and this can usually be done with a little patience, the two rows of setæ are very evident and can be seen to approach one another so as to meet, or nearly so, in the middle of the ventral opening between the two valves of the shell, as shown in fig. 1. These setæ can, however, be fairly easily seen from the side by focussing through the shell to the inner lip, especially with a rather high magnification and a strong illumination. Naturally they are still more easily seen in valves removed from the body by dissection, or which have been thrown off in moulting. The inner ventral margins of two such valves of females of *D. pulex* and *D. obtusa* respectively are shown in figs. 2 and 3.

It will be seen that in *D. pulex* the inner lip is practically parallel to the outer lip for the whole of its length, and that there are only a few short delicate setæ on its anterior part. Otherwise it is a plain ridge for about the first half of its length. The posterior half is armed with a series of rather stout serrated or shortly-feathered setæ.

In *D. obtusa*, on the other hand, the inner lip is slightly bayed inwards away from the outer lip for a short distance near its centre and this is the part which gives rise to the row of long plumose setæ already alluded to. Anterior to this bay the lip bears a continuous row of short delicate setæ and posteriorly a series of setæ similar to those in the corresponding position in *D. pulex*.

The long plumose setæ appear to be feathered on one side only, at least all the barbules point in the same backward direction (fig. 4). The number of these setæ is variable, but in the adult female there are usually about twenty, although there may be as few as ten. Such setæ are present in all stages of development of the female of *D. obtusa*, including the neonata with seven to ten, but they do not occur at any stage in *D. pulex*. They also occur in the neonata and early stages of the male of *D. obtusa*, although later they become included in the fringe of setæ which occurs along the whole of the anterior half of the inner lip in that sex of both types. They are

Figs. 2-6.

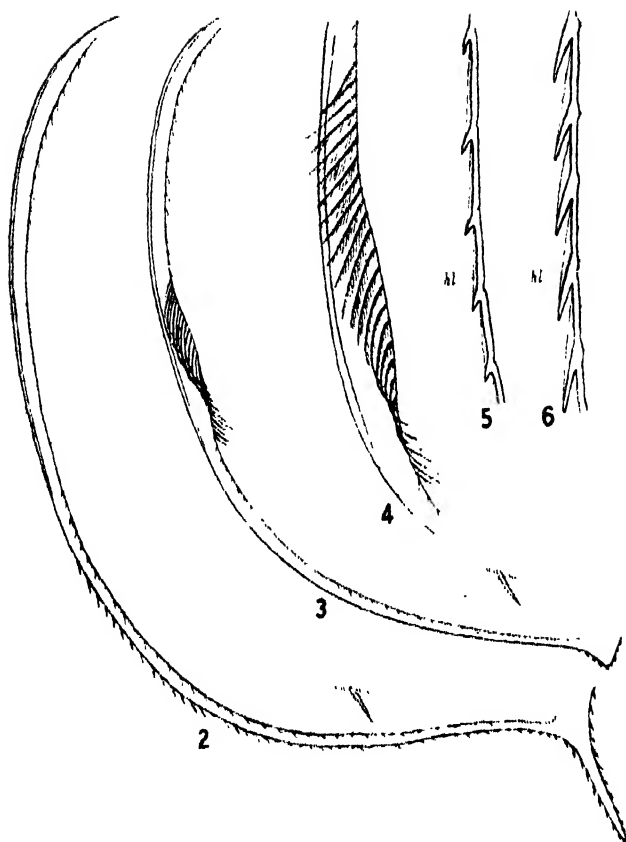


Fig. 2.—Ventral margin of moulted valve of *D. pulex*, showing inner lip.  $\times 70$ .

Fig. 3.—Ventral margin of moulted valve of *D. obtusa*, showing inner lip with slight bay near middle and plumose setae arising therefrom.  $\times 70$ .

Fig. 4.—Bay on inner lip of valve of *D. obtusa*, with plumose setae.  $\times 200$ .

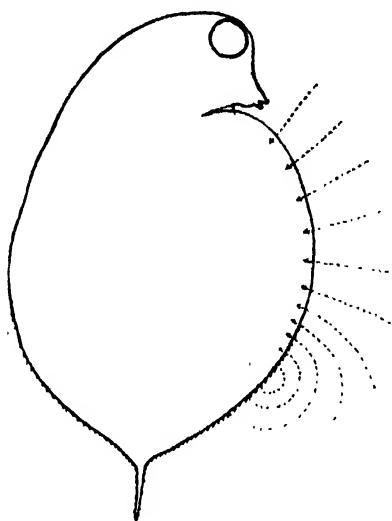
Fig. 5.—Teeth on posterior ventral margin of *D. obtusa*.  $\times 350$ .  
hl=hyaline lamella.

Fig. 6.—Teeth on posterior ventral margin of *D. pulex*.  $\times 350$ .  
hl=hyaline lamella.

not present in the neonata and early stages of the male of *D. pulex*. It is therefore possible to distinguish *D. obtusa* from *D. pulex* by the presence or absence of these setæ alone, in the female at any stage and in the male at the earlier stages.

The presence of these long plumose setæ suggests that they are of some special benefit of *D. obtusa*, possibly serving as a screen of prevent the entry of particles below

Fig. 7.



Side view of *D. pulex* (typical outline), showing currents produced by the movement of the feet.  $\times 25$ .

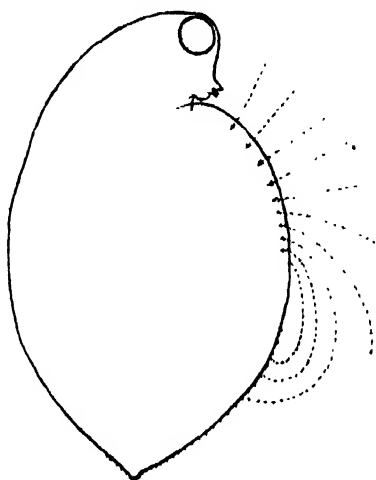
a certain point on the ventral margin of the shell. This seems to be indicated by the currents which are produced in the water when the feet of the animal are beating normally. The difference in this respect between *D. pulex* and *D. obtusa* is shown diagrammatically in figs. 7 and 8.

As typical *D. obtusa* is usually found in dirtier and more turbid water than typical *D. pulex* and only rarely in company with it, it is certainly tempting to regard the presence of these setæ as being, originally at any rate, directly correlated with the nature of the environment.



They may, however, also be connected with a habit which typical *D. obtusa* has of occasionally attaching itself by the ventral margin to the bottom and sides of the containing vessel, and therefore no doubt to aquatic

Fig. 8.



Side view of *D. obtusa* (typical outline), showing currents produced by the movement of the feet.  $\times 25$ .

vegetation. This action has been noted by Woltereck (see Woltereck, R., 1913, p. 479), and I have seen the same myself.

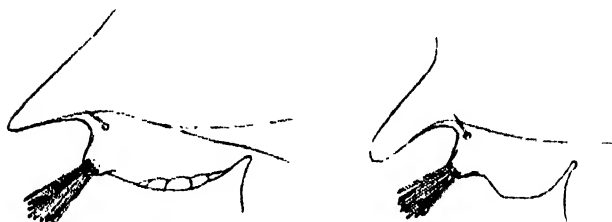
#### OTHER CHARACTERS AIDING IN THE DISTINCTION BETWEEN *D. PULEX* AND *D. OBTUSA*.

The character alluded to in the foregoing section is always associated with at least a number of other characters, which, taken together, give a very distinctive picture to the *obtusa* type of *Daphnia* as compared with the *pulex* type. Concerning some of these characters the following remarks may be made.

*Situation of the Antennules of Female.*—In *D. obtusa* the antennules of the female are situated on a distinct rather short hump under the rostrum, whereas in *D. pulex*

they are merely on a slight longish swelling. The distinction will best be seen by reference to figs. 9-10 and 11-12. The difference at first sight does not appear to be of much significance, especially as there is some degree of variability in both cases, but actually in my experience

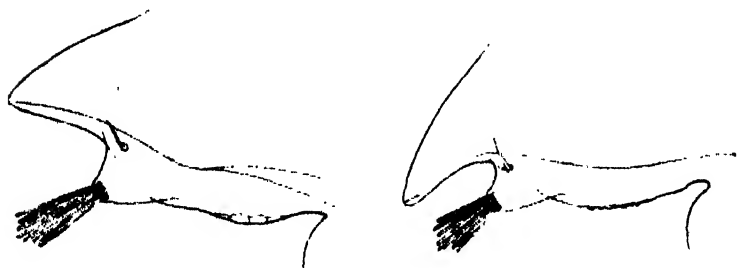
Figs. 9 & 10.



Rostral part of head of two forms of *D. obtusa*, showing hump upon which the antennules are situated.  $\times 200$ .

it is the most reliable of the four characters already referred to as being hitherto used to separate the two types. The difference applies to all forms of the two types, which is certainly not the case with the other three characters mentioned.

Figs. 11 & 12.



Rostral part of head of two forms of *D. pulex*, showing low swelling upon which the antennules are situated.  $\times 200$ .

*Number of Teeth on the Posterior Ventral Margin of the Valves.*—I have found that another almost constant distinction between the two types is that in the adult

females of *D. obtusa* the number of teeth on the posterior ventral margin (outer lip) of the valves is usually less than 25, only rarely exceeding that number, whereas in *D. pulex* there are rarely, if ever, less than 25, usually many more, up to over 80. Moreover, in *D. obtusa* the ventral margin may even be quite destitute of teeth except for a few near the shell-spine or its equivalent angle (see fig. 3), whereas in *D. pulex* the ventral margin is normally never without teeth. In the males and neonatæ of both types the difference in the numbers of teeth on the ventral margin is also distinctive, being in *D. obtusa*, male about 20, neonata 12–15, rarely up to 20, in *D. pulex*, male not less than about 25, usually 30–35 or more, neonata 20 or more.

*Length of Teeth on the Posterior Ventral Margin.*—There is a fairly constant difference also between the length of the teeth on the ventral margin in the two types at least as regards the anterior and middle sections of the series. In *D. obtusa* the teeth, when present, are usually quite short, only rarely being longer than half the length of the interspaces between them (see fig. 5). In *D. pulex* the teeth are usually almost as long as the interspaces and therefore nearly overlapping (see fig. 6). The neonatæ of the two types, both male and female, show much the same relative difference in the sizes of these teeth.

*Number of Teeth on the Posterior Dorsal Margin of the Shell.*—This is also a moderately reliable distinction between the two types. In *D. obtusa* there are very few teeth, usually only 5–10 near the shell-spine, or its equivalent angle, rarely as many as 20\*. In *D. pulex* these teeth are usually more numerous, 20 to 50 or more, but in one variety at least there may be only a few near the shell-spine. In the males and neonatæ of both types the same general rule holds good, the numbers being in *D. obtusa*, male none or a few only near the shell-spine, neonata none or rarely more than 5, in *D. pulex*, male usually from 12 to 20 or more, neonata usually at least 5, very rarely absent.

\* The numbers given are for a single row. There are always two rows of teeth on the dorsal margin of the shell,

*Length of Shell-Spine.*—The length of the shell-spine in all forms of *Daphnia* is a very variable character, depending largely upon age, season and conditions of existence. The absence or practical absence of this spine in the adult females of *D. obtusa*, considered by Kurz himself (see Kurz, W., 1874) and many other authors as a most important feature of the species, is not really a reliable character in all cases. Although it is fairly characteristic of the adult, and especially of the older females of the more typical forms, there are other forms of the *obtusa* type, recognized as such on other grounds (e. g., *D. propinqua* Sars, see Sars, G. O., 1895 & 1916\*), in which the shell-spine is never absent or even so short as it may be in some *pulex* forms. Nevertheless the *obtusa* types are characterized by shorter shell-spines than the *pulex* types, and in none of the latter is this spine normally absent. Individual specimens may indeed be seen at times without a shell-spine, but these cases are to be explained as due to accident or sometimes perhaps as a post-ephippial condition. Speaking generally it may be said that while in the *pulex* forms the shell-spine is quite commonly at least about one-fifth of the valve-length, it only rarely reaches that length in the *obtusa* forms. Well-developed shell-spines are always present in the neonatæ, young females, and the males of both types.

*Ephippium.*—Judging from the comparatively few ephippia so far available, there is usually a slight difference in outline between the ephippia of the two types, at least in the more typical forms (see figs. 13 and 14). In *D. obtusa* the ephippium appears broader than in *D. pulex*, while its anterior margin is at a right angle or a little more to the dorsal margin, whereas in *D. pulex* it is usually at slightly less than a right angle. The polygonal cell-structure is also coarser in *D. obtusa* than in *D. pulex*, being about  $\frac{1}{2000}$  in. in diameter as compared with  $\frac{1}{3000}$  in.

*Flagellum on the Antennule of the Adult Male.*—In typical *D. obtusa* at least this is usually from three to

\* Specimens of a form from South Africa closely resembling that described by Sars were found to possess the plumose seta on the inner lip of the valves.

Fig. 13.

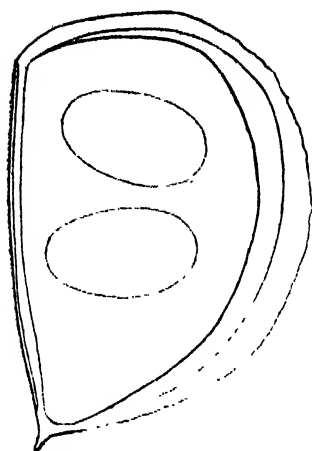
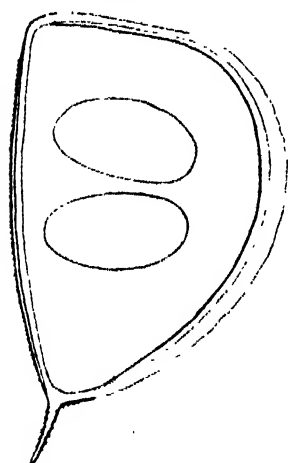
Ephippium of *D. obtusa*.  $\times 60$ .

Fig. 14.

Ephippium of *D. pulax*.  $\times 40$ .

four times the length of the longest olfactory setæ (fig. 15), whereas in typical *D. pulex* it is usually only about two to three times that length (fig. 16).

Fig. 15.

Antennule of *D. obtusa*, ♂. × 180.

Fig. 16.

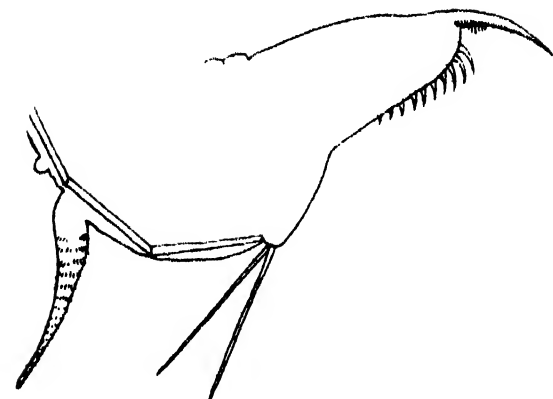
Antennule of *D. pulex*, ♂. × 180.

*Dorsal Abdominal Processes of the Adult Male.*—In the male of typical *D. pulex* one of the abdominal processes, corresponding to the second in the female \*, is very much elongated (fig. 17), so that it projects well beyond the margin of the shell. The other processes are usually rudimentary or absent, the third and fourth, or the corresponding section of the abdomen, being hairless. In contrast to this the male of typical *D. obtusa* has the second process only moderately developed (fig. 18), rarely reaching to or beyond the shell, the others being rudimentary or absent, the third and fourth being hairy. There are varieties of *D. pulex*, however, in which the development of these processes is not the same as in the typical form, and one of these at least more resembles *D. obtusa*, while in another it is the first process which is moderately developed, the second being only rudimentary.

*Bay on the Dorsal Margin of the Post-Abdomen of the Adult Male.*—A deep, almost angulated bay is character-

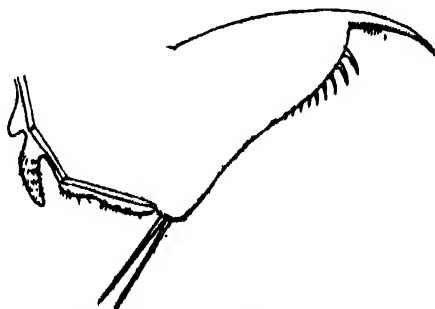
\* In counting the four processes the anterior one is regarded as the first. When any are absent the position in the series of the one or more present can be determined by reference to the slips of muscle along the margin of the abdomen.

Fig. 17.

Post-abdomen of *D. pulex*, ♂.  $\times 110$ .

istic of the male of typical *D. pulex* (fig. 17), and a shallow bay of typical *D. obtusa* (fig. 18). There is, however, at

Fig. 18.

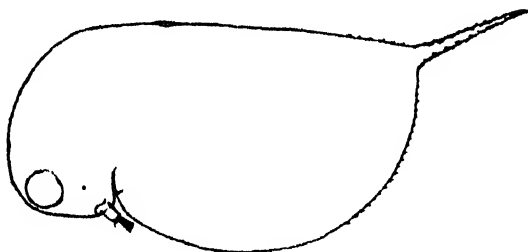
Post-abdomen of *D. obtusa*, ♂.  $\times 110$ .

least one variety of *D. pulex* in which the bay is scarcely more marked than in *D. obtusa*.

*Front of Head of Male Neonata.*—In addition to the differences already noted with regard to the neonatæ of the two types, the male neonatæ appear to be distinguishable in yet another way. In the comparatively small

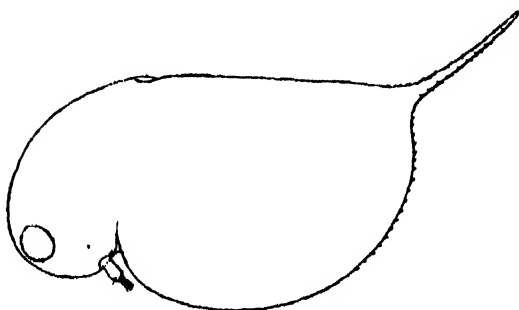
number of male neonatæ seen, the front of the head in *D. pulex* was usually straight or even slightly concave

Fig. 19.

Neonata of *D. pulex*, ♂. × 65.

(fig. 19), whereas in *D. obtusa* it was more or less convex (fig. 20).

Fig. 20.

Neonata of *D. obtusa*, ♂. × 65.

#### THE POSSIBLE OCCURRENCE OF HYBRIDS.

It has already been mentioned incidentally that *pulex* and *obtusa* forms are only rarely found living together. Out of many scores of collections I have only seen them together on five occasions. Nevertheless, the fact that they can occur together opens up the possibility that hybrids may sometimes be produced in nature, as indeed



they have been artificially. Some years ago, Professor W. E. Agar sent me a few specimens resulting from a cross between a *pulex* ♀ and an *obtusa* ♂, which he had successfully carried out. In the main the hybrids resembled the *obtusa* more than the *pulex* type, although in certain respects they were more like the latter, while some characters were definitely intermediate. This possibility of the production of hybrids obviously raises the question whether any of the forms of the two types found in nature can be the result of crossing. While it is impossible in the present state of our knowledge to say for certain that this is not the case, I do not think there is any evidence so far in favour of that view. In spite of the approximation of the more variable characters to one another in some cases, none of the forms I have seen have suggested that they were the result of crossing, for I have never had any difficulty in placing the specimens in one category or the other.

#### CONCLUSION.

From the foregoing account of the differences between the two types it seems clear that the *obtusa* forms constitute a group which at the very least is worthy of separate specific rank, thus leaving the remainder of the forms now very generally included under *D. pulex* as the sole representatives of that species. It is very probable, however, that we are really dealing with more than two species. Both types include a considerable number of named and unnamed forms \*, and although it has not been possible, with the unreliable characters hitherto employed, to be sure that any of these could be regarded as good species, evidence is now accumulating that some at least do possess small constant distinguishing morphological characters †. It is, of course largely a matter of convenience how such forms are to be regarded, but their existence appears to justify the view that in *D. pulex* and *D. obtusa* we are concerned not merely with two species.

\* It is very difficult to say definitely which of the named "*pulex*" forms belong to each of the two types dealt with in this paper, but the following, quite or almost certainly, belong to the *obtusa* type:—*D. obtusa* Kurz, *D. brevispina* Daday, *D. ornata* Daday, *D. alpina* Daday, *D. jurinei* Stingelin, *D. propinqua* Sara, and *D. morsei* Ishikawa.

† It is hoped in a subsequent paper to give some examples of these.

and their indefinite varieties, but with two series of forms in various stages of evolution, which have developed along more or less parallel lines\* from two originally strongly contrasted species.

SUMMARY OF DIFFERENCES BETWEEN THE "PULEX"  
AND "OBTUSA" TYPES OF *DAPHNIA*.

*Adult Females.*

	<i>D. pulex</i> and its varieties.	<i>D. obtusa</i> and its varieties.
Long plumose setæ on central part of inner lip of ventral margin. Inner lip of ventral margin.	Absent.  A uniformly curved line practically parallel with outer lip.	Present. 10-20 or more in a single row.  With a slight inward bay in central part, i. e., the part bearing the plumose setæ.
Antennules .....	On an elongated low swelling.	On a short prominent hump.
Number of teeth on the posterior ventral margin.	Numerous, 25-80 or more, normally never absent.	As a rule less than 25, rarely up to 30, often entirely absent or with only a few near shell-spine.
Length of teeth on the posterior ventral margin.	Usually rather long and nearly overlapping, i. e., about as long as the interspaces.	When present, usually quite short, only rarely exceeding half the length of the interspaces.
Number of teeth on the posterior dorsal margin (single row).	As a rule numerous, 20-50 or more, but in some varieties only a few near the shell-spine.	As a rule only a few, say 5-10, near the shell-spine, rarely as many as 20.
Shell-spine .....	Commonly about one-fifth valve-length, but very variable (more than one-third to less than one-twelfth valve-length) never absent as a normal feature.	Usually very short, often absent, but in some forms reaching one-fifth valve-length.
Ephippium .....	Anterior margin usually at slightly less than a right-angle to back. Polygonal structure fine, 1/3000 inch.	Anterior margin at a right-angle or a little more to back. Polygonal structure rather coarse, 1/2000 inch.

\* For example, both have developed certain pelagic or semi-pelagic forms.

*Neonatae, Females.*

	<i>D. pulex.</i>	<i>D. obtusa.</i>
Long plumose setae on central part of inner lip of ventral margin.	Absent.	Present. 7-10 in a single row.
Number of teeth on the posterior ventral margin.	20 or more.	12-15, rarely up to 20.
Length of teeth on the posterior ventral margin.	About as long or longer than the interspaces.	Usually shorter than half the length of the interspaces.
Number of teeth on the posterior dorsal margin (single row).	Usually 5 or more, very rarely absent.	Usually absent or up to 5, rarely more.

*Adult Males.*

	<i>D. pulex.</i>	<i>D. obtusa.</i>
Flagellum on antennules.	Usually only 2 to 3 times length of longest olfactory setae.	Usually 3 to 4 times length of longest olfactory setae.
Dorsal abdominal processes.	Typical <i>D. pulex</i> * has one (the second) very long, projecting well beyond the valves. The others usually rudimentary or absent. The 3rd and 4th not hairy.	The second process only moderately developed, rarely projecting slightly beyond the valves. The others rudimentary or absent. The 3rd and 4th hairy.
Post-abdomen . . . .	Typical <i>D. pulex</i> with a deep bay on the dorsal margin†.	With only a shallow bay on the dorsal margin.
Number of teeth on the posterior ventral margin.	Not less than about 25, usually 30-35 or more.	About 20.
Number of teeth on the posterior dorsal margin (single row).	Usually from 12-20 or more.	None, or a few only near the shell-spine.

*Neonatae, Males.*

	<i>D. pulex.</i>	<i>D. obtusa.</i>
Front of head . . . . .	Usually straight or even slightly concave.	More or less convex.
Other differences, as in Neonatae, females.		

\* There are varieties of *D. pulex* in which the processes are not developed as in the more typical forms.

† There is at least one variety with only a shallow bay.

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XX.—*New or little-known Tipulidæ (Diptera).*—LXII, *Neotropical Species.* By CHARLES P. ALEXANDER, Ph.D., F.R.E.S., Massachusetts State College, Amherst, Massachusetts, U.S.A.

ALL species discussed at this time are from Peru, and belong to the vast genus *Limonia* Meigen. They were collected chiefly by Mr. Felix Woytkowski, almost all in the Department of Junin; a few other species were taken by Mr. Pedro Paprzycki, likewise in the Department of Junin, and by Mr. J. Adger Smyth, in the Department of Puno. I am very greatly indebted to these entomologists for their continued interest in saving these fragile flies. All types are preserved in my collection of the Tipulidæ.

*Limonia (Dicranomyia) smythiana*, sp. n.

General coloration obscure yellow, the mesonotum restrictedly darkened; antennæ with flagellar segments weakly bicolored; thoracic pleura with a conspicuous dark brown longitudinal stripe, more diffuse behind; legs yellow, the femora with a conspicuous brownish black subterminal ring; wings brownish yellow, the veins behind *Sc* with numerous small brown dots to present a sparsely guttate appearance; *m-cu* more than three times its own length before the fork of *M*; male hypopygium with the rostral prolongation of the ventral dististyle bearing two separate spines.

*Male*.—Length about 10 mm. ; wing 14.5 mm.

Rostrum brownish black ; palpi black. Antennæ with scape and pedicel black, the former sparsely pruinose ; flagellar segments weakly bicoloured, the bases obscure yellow, the tips darkened ; flagellar segments long-oval ; longest verticils a little longer than the segments. Head light brown, restrictedly darkened medially ; anterior vertex relatively wide, nearly three times the diameter of the scape.

Pronotum yellow, narrowly darkened along ventral margins. Mesonotum obscure yellow to brownish yellow, the præscutum with three scarcely indicated darker stripes ; scutal lobes weakly darkened ; lateral margins of mediotergite weakly infuscated. Pleura buffy, with a narrow but conspicuous dark brown stripe extending from the propleura across the anepisternum onto the pteropleurite and pleurotergite, paler and more diffuse behind ; ventral sternopleurite more chestnut-brown. Halteres with stem pale brown, knob slightly more darkened. Legs with the coxæ and trochanters obscure yellow ; femora yellow with a conspicuous brownish-black subterminal ring, the clear yellow tip a little narrower ; tibiæ yellow, the tips very weakly darkened ; tarsi obscure yellow, the terminal segments blackened. Wings (fig. 1) large and ample ; ground-colour brownish yellow, the prearcular field, cell *Sc* and the stigma clearer yellow ; all veins of wing behind *Sc* with scattered small brown spots to present a sparsely guttate appearance ; costa unvariegated ; veins yellow, dark brown in the spotted areas. Venation : *Sc* of moderate length, *Sc*<sub>1</sub> ending a short distance beyond origin of *Rs*, *Sc*<sub>1</sub> long, only a little shorter than *Rs* ; basal section of *R*<sub>4+5</sub> arcuated, exceeding one-half *Rs* ; *R*<sub>2</sub> and the short free tip of *Sc*<sub>2</sub> in transverse alignment ; cell 1st *M*<sub>2</sub> short-pentagonal, shorter than vein *M*<sub>3</sub> beyond it ; *m-cu* an unusual distance before the fork of *M*, almost at mid-length of wing and more than three times its own length before the fork.

Abdomen obscure yellow, narrowly darkened laterally, with conspicuous erect white setæ ; hypopygium obscure yellow. Male hypopygium with the dorsal dististyle a short curved rod, the apex obtuse. Ventral dististyle of moderate size, with two subequal rostral spines from

short basal tubercles, the outer spine close to apex of prolongation, the separate inner spine lying more basad. Gonapophyses with the blade broad, the mesal-apical lobe slender.

*Hab.* Peru (Puno).

*Holotype*, ♂, Chucuito, Lake Titicaca. altitude 12,000 feet, August 28, 1939 (*J. Adger Smyth*).

I am very pleased to name this fly in honour of Mr. J. Adger Smyth, who collected several species of Tipulidæ in the near vicinity of Lake Titicaca. The venation, especially of the medial and cubital fields, is approached only in the species next described among the now more than one thousand species in the vast genus *Limonia*. This great recession of *m-cu* is paralleled in the genus *Orimarga* Osten Sacken. The male hypopygium of this fly is quite normal for a member of the subgenus, showing no unusual features as might be expected from the nature of the venation.

*Limonia (Dicranomyia) perretracta*, sp. n.

Most similar to *smythiana*; general coloration grey, the præscutum patterned with brown and black; halteres elongate, black, the base of stem and apex of knob paler; femora obscure yellow, with a narrow, but conspicuous black ring that is almost apical in position; wings greyish subhyaline, heavily dotted with brown along the veins and in the cells; inner end of cell 1st *M*<sub>2</sub> arcuated; *m-cu* more than twice its length before the fork of *M*.

*Female*.—Length about 10 mm.; wing 14 mm.

Rostrum dark brown, sparsely pruinose; palpi black. Antennæ black throughout; flagellar segments oval. Head brownish grey; anterior vertex relatively broad, about two and one-half times the greatest diameter of the scape.

Pronotum dark brown, sparsely pruinose. Mesonotum grey, patterned with darker grey and brown; præscutum with the usual median stripe darker, especially on anterior half, its posterior third conspicuously bordered by black; a similar blackened sublateral line at suture, the usual lateral præscutal stripes poorly indicated; centres of scutal lobes darkened; scutellum light reddish yellow, darkened medially at base; postnotum light grey pruinose on cephalic half, blackened behind. Pleura grey,

striped longitudinally with black, especially as a narrow dorsal stripe from the fore coxæ to the anterior margin of the pleurotergite, crossing the anepisternum and pteropleurite; ventral sternopleurite similarly blackened, forming a lower stripe. Halteres long and slender, blackened, the base of stem and apex of knob restrictedly obscure yellow. Legs with the coxæ dark brown; trochanters a little brightened; femora obscure yellow, with a narrow but conspicuous black ring that is nearly apical in position; tibiæ and basitarsi brownish yellow, the tips more narrowly blackened; remainder of tarsi black. Wings greyish subhyaline, heavily dotted with circular brown areas along all veins and in the centres of all cells; stigmal area oval, brownish yellow, similarly variegated with brown dots; cord and outer end of cell 1st  $M_2$  with somewhat larger darkened spots; veins brown,  $Sc$  more yellow. Venation:  $Sc_1$  ending just beyond origin of  $Rs$ ,  $Sc_2$  only a short distance from its tip, lying just basad of origin of  $Rs$ ; inner end of cell 1st  $M_2$  strongly arcuated so that  $r-m$  is at near mid-length of the cell;  $m-cu$  gently sinuous, lying more than twice its length before the fork of  $M$ .

Abdomen brownish black, the central portions of the segments paling to obscure yellow, the posterior borders darkened; outer segments more uniformly infuscated. Ovipositor with all valves straight and slender.

*Hab.* Peru (Junin).

*Holotype*, ♀, Huasahuasi, Tarma, altitude 2800 metres, April 13, 1940 (*Woytkowski*).

The most similar species is *Limonia* (*Dicranomyia*) *mythiana*, sp. n., likewise from the high mountains of Peru. The present fly differs in all details of coloration of the body, legs and wings, and in the venation.

*Limonia* (*Dicranomyia*) *anax*, sp. n.

Size large (wing over 11 mm.); general coloration reddish yellow, the præscutum with four dark brown stripes, the intermediate pair narrowly separated by a capillary grey line; scutellum with a dark line on either side of the pale central portion; pleura buffy, with a broad brownish-black longitudinal stripe; halteres with dark brown knobs; legs obscure yellow; wings narrow, yellow, restrictedly patterned with brown;  $Sc_2$  near tip

of  $Sc_1$ ; abdominal tergites dark brown, variegated with yellow; sternites yellow, the lateral borders narrowly darkened; male hypopygium with the ninth tergite conspicuously emarginate; rostrum small, with the spines unequal, separate at base.

*Male*.—Length about 8–9 mm.; wing 11.5–12.5 mm.

*Female*.—Length about 11 mm.; wing 13 mm.

Rostrum and palpi black. Antennæ with the scape obscure yellow, darkened outwardly; remainder of organ passing through brown to brownish black; flagellar segments oval, the outer ones long-oval, the verticils subequal in length to the segments; terminal segment about one-fifth longer than the penultimate. Head greyish brown; anterior vertex narrow.

Pronotum buffy, dark brown medially on posterior portion. Mesonotal præscutum reddish yellow, with four distinct dark brown stripes, the intermediate pair separated only by a capillary grey vitta; scutal lobes brownish black, the median area broadly pale; scutellum brownish yellow, traversed by two narrow brownish black lines that converge posteriorly; mediotergite brownish grey. In some specimens the dark lines on the scutellum are more extensive, restricting the pale ground to a narrow central line and to reduced lateral margins; in still other specimens the pale median præscutal vitta is so restricted as to be little apparent. Pleura buffy, with a broad conspicuous brownish-black longitudinal stripe extending from the propleura to the pleurotergite, widest and most intense on the anepisternum; sternopleurite more weakly darkened. Halteres with stem long, obscure yellow, knob dark brown. Legs with the coxæ and trochanters greenish testaceous, the fore coxæ weakly darkened at base; remainder of legs obscure yellow, the outer tarsal segments passing into brown. Wings narrower than usual; ground-colour yellow, restrictedly patterned; a brown seam in axillary region and along more than the basal half of vein  $Cu$ ; still narrower dark seams along cord, outer end of cell 1st  $M_2$ , both ends of the yellow stigma, and as a narrow seam on outer portion of vein  $M$ ; outer veins more or less distinctly darkened, especially on the veins themselves; costal cell more or less distinctly infumated; veins yellow, darker in the infuscated portions. Venation:  $Sc_1$



ending just before origin of  $Rs$ ,  $Sc_2$  near its tip;  $Rs$  about one-third to one-half longer than the basal section of  $R_{4+5}$ ;  $m-cu$  a short distance before the fork of  $M$ .

Abdominal tergites dark brown, the extreme cephalo-lateral angles and narrow posterior borders of the segments reddish yellow; sternites yellow, the lateral margins narrowly dark brown, broken at posterior borders; hypopygium yellow, the basistyles darker, the ventral

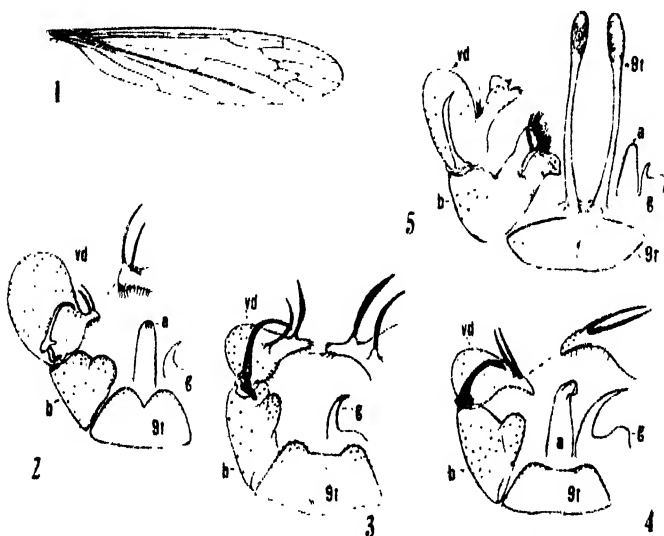


Fig. 1.—*Limonia (Dicranomyia) smythiana*, sp. n.; venation.  
 Fig. 2.—*Limonia (Dicranomyia) anax*, sp. n.; male hypopygium.  
 Fig. 3.—*Limonia (Dicranomyia) latispina*, sp. n.; male hypopygium.  
 Fig. 4.—*Limonia (Dicranomyia) scimitar*, sp. n.; male hypopygium.  
 Fig. 5.—*Limonia (Dicranomyia) diura*, sp. n.; male hypopygium.

(Symbols: a, aedeagus; b, basistyle; g, gonapophysis;  
 t, 9th tergite; vd, ventral dististyle.)

dististyle light yellow. Ovipositor with valves long and nearly straight. Male hypopygium (fig. 2) with the ninth tergite,  $9t$ , conspicuously notched medially, the lobes obtuse. Basistyle,  $b$ , with the ventro-mesal lobe sub-basal in position, nearly globular in outline. Dorsal dististyle a gently curved rod, the tip subobtuse. Ventral dististyle,  $vd$ , fleshy, considerably larger than the basistyle;

rostral prolongation small, with two unequal rostral spines, the longest far out near tip of rostrum, which slopes off precipitously beyond it; inner spine about four-fifths as long, the spines distinctly separate at base. Gonapophyses, *g.* with mesal-apical lobe a gently curved pale blade.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huasahuasi, Tarma, altitude 2800 metres, April 20, 1940 (*Woytkowski*). *Allotopotype*, ♀, April 24, 1940. *Paratopotypes*, 2 ♂♂, April 10–20, 1940.

*Limonia* (*Dicranomyia*) *anax* is readily told from all other large-sized regional species of the subgenus by the narrow wings, distinctive body-coloration, and the structure of the male hypopygium. Among the described species it is most similar to *L. (D.) sanctæ-cruzæ* Alexander, of southern Argentina and Chile, but the resemblance is not particularly close.

*Limonia* (*Dicranomyia*) *ariadne*, sp. n.

General coloration dark grey, the præscutum patterned with brown; antennæ black throughout; halteres long, stem yellow, knob dark brown; legs black, the femoral bases paler; wings whitish subhyaline, with a pale brownish-grey reticulated pattern, the individual areas appearing as transverse dashes in all the cells, but with those at mid-length of wing tending to line into almost complete but very narrow bands; *m-cu* close to fork of *M*; male hypopygium with the ventral dististyle small, the two rostral spines long and gently curved, subequal in size.

*Male*.—Length about 6 mm.; wing 7 mm.

Rostrum grey; palpi black. Antennæ brownish black throughout; flagellar segments oval, of almost uniform size with the exception of the last, which is about one-third longer than the penultimate. Head dark grey.

Pronotum dark grey. Mesonotum grey, the præscutum with brown stripes, including an intermediate pair that are longer and almost confluent, together with short, incomplete lateral areas. Pleura uniformly grey. Halteres relatively long, stem yellow, knob dark brown. Legs with the coxæ dark grey; trochanters obscure yellow; femora brownish black, the bases obscure yellow, most extensive

on the hind pair; tibiae and tarsi black. Wings whitish subhyaline, with a pale but conspicuous brownish-grey pattern that is reticulately distributed, with narrow transverse dashes in all cells; at mid-length of wing the individual dashes are in alignment so that almost complete crossbands are formed; stigma restricted in area; extreme wing-base yellow; veins brown, brightened at wing-base. Venation:  $Sc$  relatively short,  $Sc_1$  ending opposite origin of  $R_s$ ,  $Sc_2$  far from its tip;  $R_2$  and free tip of  $Sc_2$  in transverse alignment; cell 1st  $M_2$  nearly as long as vein  $M_{1+2}$  beyond it;  $m-cu$  variable in position, in the left wing of type about one-third its length beyond fork of  $M$ , in the right wing only about one-half this distance.

Abdomen dark grey; hypopygium dark. Male hypopygium with the caudal border of ninth tergite broadly emarginate, the lobes low and obtuse. Ventral dististyle very small, its area only about one-half that of the basistyle; rostral prolongation conspicuous, provided with two long curved spines that are subequal in length to the total length of the prolongation, placed close together on the outer third; spines gently curved, subequal in size. Dorsal dististyle a strongly curved black sickle. Gonapophyses with mesal-apical lobe appearing as a nearly straight blackened spine, the extreme tip out-curved.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huacapistana, Tarma, altitude 3800-5400 feet, February 10, 1940 (*Woytkowski*).

*Limonia* (*Dicranomyia*) *ariadne* is most similar to *L. (D.) trinitatis* Alexander, of Cuba, differing especially in the large size and in the structure of the male hypopygium, where every detail is distinct in the two species.

*Limonia* (*Dicranomyia*) *latispina*, sp. n.

Size large (wing about 9 mm.); general coloration yellowish brown, the praescutum with three darker brownish-grey stripes; pleura buffy yellow, unmarked; wings brownish yellow, the more intensely yellow stigma poorly defined;  $m-cu$  beyond the fork of  $M$ ; male hypopygium with the ventral dististyle unusually small, with two separated rostral spines that are conspicuously flattened, blade-like.

*Male*.—Length about 8–8.5 mm. ; wing 9–9.5 mm.

Rostrum light yellow ; palpi dark brown. Antennæ black ; flagellar segments oval to long-oval, the segments constricted at the incisures, the more basal ones with short pale pedicels ; verticils relatively short ; terminal segment about one-fourth longer than the penultimate. Head buffy grey ; anterior vertex a little wider than the diameter of scape.

Pronotum long, yellowish brown. Mesonotum yellowish brown, the præscutum with three darker brownish grey stripes, the median one slightly split behind, the lateral pair less distinct ; scutal lobes weakly darkened ; posterior sclerites of notum pale yellow. Pleura buffy yellow, unmarked. Halteres dusky, the stem relatively long. Legs with the coxæ and trochanters greenish yellow ; remainder of legs obscure yellow, the terminal tarsal segments darkened. Wings with a brownish-yellow tinge, the stigma poorly indicated, more intensely yellow ; veins pale brown, *Sc* more yellow. Venation : *Sc*<sub>1</sub> ending opposite origin of *Rs*, *Sc*<sub>2</sub> a short distance from its tip ; *m-cu* shortly beyond fork of *M*.

Abdomen long ; tergites brown, basal sternites yellow, the outer segments darkened ; hypopygium yellow. Male hypopygium (fig. 3) with the tergite, *9t*, large, narrowed outwardly, the median area of the caudal border transverse, the lateral angles produced into low setiferous lobes. Basistyle, *b*, long, with a conspicuous simple ventro-mesal lobe. Dorsal dististyle a long curved sclerotized sickle, equal in length to the ventral dististyle. Ventral dististyle, *vd*, unusually small, its area much less than that of basistyle ; rostral prolongation conspicuous, pale, its tip broadly obtuse ; two widely separated rostral spines from low tubercles, both spines conspicuously flattened, the outermost especially so. Gonapophyses, *g*, with the mesal-apical lobe long and conspicuous, only gently curved.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huasahuasi, Tarma, altitude 2800 metres, April 3, 1940 (Woytkowski). *Paratopotypes*, several ♂♂.

In the structure of the male hypopygium, *Limonia* (*Dicranomyia*) *latispina* is entirely different from other described species. In some respects it suggests forms

like *L. (D.) errabunda* Alexander and *L. (D.) repentina* Alexander, but is quite distinct.

*Limonia (Dicranomyia) scimitar*, sp. n.

General coloration grey, the præscutum with a broad, dark brown, median stripe, the lateral stripes reduced; antennæ black throughout; wings with a greyish tinge, the oval stigma pale brown, a little darker than the ground; *Sc* short, *Sc*<sub>1</sub> long, subequal to *Rs* or to the basal section of *R*<sub>4+5</sub>; male hypopygium with the ventral dististyle small, with two long black rostral spines; mesal-apical lobes of gonapophyses of unusual size, appearing as long sword-shaped blades.

*Male*.—Length about 5.5–7 mm.; wing 6–7.5 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval, becoming more elongate outwardly; verticils subequal to the segments. Head brownish grey, the anterior vertex clearer grey, with a median black line; anterior vertex nearly twice the diameter of scape.

Pronotum brown medially, grey on sides. Mesonotum brownish grey, the præscutum with a broad, dark brown, median stripe that does not reach the suture; lateral stripes feebly indicated to almost obsolete, the lateral præscutal borders light grey; scutal lobes darkened, the median area pale; posterior sclerites of notum grey. Pleura grey, the ventral sternopleurite somewhat darker. Halteres dusky. Legs with the coxæ brownish grey; trochanters obscure yellow; remainder of legs dark brown, the tarsi passing into black. Wings with a greyish tinge, the oval stigma pale brown, a little darker than the ground; veins brown. Venation: *Sc* short, *Sc*<sub>1</sub> ending a short distance before origin of *Rs*, *Sc*<sub>2</sub> far from its tip, *Sc*<sub>1</sub> subequal in length to *Rs* or basal section of *R*<sub>4+5</sub>; *m-cu* shortly before the fork of *M*.

Abdomen dark brown, sparsely pruinose; hypopygium somewhat brightened. Male hypopygium (fig. 4) with the caudal margin of the ninth tergite, 9t, slightly emarginate, the lateral lobes low to very low. Basistyle, *b*, relatively long, much larger than the ventral dististyle, its ventro-mesal lobe simple. Dorsal dististyle a stout, gently curved rod, the tip acute. Ventral dististyle, *vd*, with the body small, the rostral prolongation long, compressed, with two very long, somewhat flattened

spines, the outermost from a small tubercle, the inner spine at its base, sessile. Gonapophyses, *g*, with the mesal-apical lobe of unusual size, appearing as a long sword-shaped blade that is directed laterad and caudad.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huasahuasi, Tarma, altitude 2800 metres, April 10, 1940 (*Woytkowski*). *Paratopotypes*, several ♂♂, April 10–22, 1940.

*Limonia* (*Dicranomyia*) *scimitar* superficially resembles *L. (D.) mutata* Alexander, of Mount Roraima, Venezuela, but differs from this, as well as from all other regional species, by the unusual lobes of the gonapophyses of the male hypopygium. The somewhat flattened rostral spines suggest the condition found in *L. (D.) lutispina*, sp. n., and the two flies appear to be closely allied.

*Limonia* (*Dicranomyia*) *diura*, sp. n.

Allied to *divisa*; general coloration reddish brown; halteres very long; wings weakly tinged with brownish yellow, the oval stigma a little darker; *Sc* short, *Sc*<sub>1</sub> long; male hypopygium very complex in structure; ninth tergite on ventral face produced caudad into two long pale rods that are weakly dilated into darkened clubs at their tips; ventro-mesal lobe of basistyle complex; rostral prolongation of ventral dististyle expanded outwardly.

*Male*.—Length about 6.5–7 mm.; wing 6.8–7 mm.

Rostrum ochreous yellow; palpi black. Antennæ with the scape brownish yellow, pedicel and flagellum black; flagellar segments oval, the terminal one elongate, more than one-half longer than the penultimate. Head brownish grey; anterior vertex wide, the eyes relatively small.

Thoracic notum almost uniformly reddish brown, without distinct markings; pleura more testaceous yellow. Halteres very long, infuscated, the base of stem paler. Legs with the coxæ and trochanters yellow; femora obscure yellow; tibiæ and tarsi passing into dark brown or brownish black. Wings with a weak brownish-yellow tinge, the small oval stigma a little darker brown; prearcular field more yellowish; veins brown, more flavous in the prearcular field. Venation: *Sc* short, *Sc*<sub>1</sub> ending some distance before the origin of *Rs*, *Sc*<sub>2</sub> far from its tip,

*Sc*<sub>1</sub> alone subequal in length to the arcuated *Rs*; cell 1st *M*<sub>2</sub> small; *m-cu* about one-half its length before the fork of *M*.

Abdominal tergites dark brown; sternites yellow; subterminal segments more infuscated; male hypopygium large, blackened on basal portions, the remainder yellow. Male hypopygium (fig. 5) with the tergite, 9t, transverse, the cephalic border more convexly rounded than the caudal margin, black, bordered caudally by pale; from beneath the tergite arise two elongate pale rods that extend caudad beyond all other elements of the hypopygium, at apex each expanded into an elongate-oval blackened club. Basistyle, *b*, small, the ventromesal lobe very complex, bearing in addition to numerous apical setae and smaller lateral groups of bristles an oblique row of about seven major setae on outer lobe and a single bristle of unusual length, being nearly two-thirds the length of the entire lobe. Dorsal dististyle only gently curved, the tip acute. Ventral dististyle, *vd*, relatively small, its area less than the total area of basistyle; rostral prolongation blackened, irregularly expanded and weakly bilobed at apex; rostral spines small, two in number, placed near base of prolongation. Gonapophyses small, pale; mesal-apical lobe nearly straight. Aedeagus small and simple.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huacapistana, Tarma, altitude 3600–5400 ft. March 14, 1940 (*Woytkowski*). *Paratopotype*, ♂, March 12, 1940.

*Limonia* (*Dicranomyia*) *diura* is readily distinguished from all described species of the subgenus by the remarkable structure of the male hypopygium. There are now somewhat numerous species in the Neotropical fauna that centre about *divisa*, all more or less similar in general appearance yet differing remarkably in the structure of the male hypopygium. Such species include *L. (D.) boliviana* Alexander, *L. (D.) divisa* Alexander, *L. (D.) filicauda* Alexander, *L. (D.) longiventris* Alexander, and *L. (D.) similissima* Alexander.

*Limonia* (*Dicranomyia*) *apposita*, sp. n.

Allied to *longiventris*; general coloration of thorax medium brown; halteres very long; wings with a strong

dusky tinge,  $Sc_1$  very long; male hypopygium with the ventro-mesal lobe of basistyle complex; rostral prolongation of ventral dististyle long and slender, especially on distal third; rostral spines on about the basal third, arising from a common tubercle.

*Male*.—Length about 5.5–6 mm.; wing 6–6.3 mm.

*Female*.—Length about 6.5 mm.; wing 7 mm.

Rostrum pale brown; palpi black. Antennæ black; flagellar segments oval to elongate. Head brown, passing into greyish brown behind.

Pronotum dark brown. Mesonotum almost uniformly medium brown, the pleura slightly paler. Halteres very long, brownish black; stem on distal half with long conspicuous setæ. Legs with coxæ and trochanters testaceous yellow; remainder of legs dark brown to brownish black. Wings with a strong dusky tinge, the oval stigma still darker but inconspicuous; veins dark brown. Venation:  $Sc_1$  ending about opposite or just beyond the origin of  $R_s$ ,  $Sc_2$  very far from its tip,  $Sc_1$  alone longer than  $R_s$ ;  $m-cu$  close to the fork of  $M$ .

Abdomen brownish black, the sternites slightly paler. Male hypopygium (fig. 6) with the tergite,  $9t$ , transverse, the caudal margin truncate or virtually so. Basistyle,  $b$ , with the ventro-mesal lobe complex, including two expanded lobes, the more basal one wider, margined apically with long setæ, those at distal end of row becoming shorter and more spinous; outer lobe longer but narrower, pale, tufted, with long curled setæ. Dorsal dististyle a long curved rod, constricted at base, the tip extended into a long straight point. Ventral dististyle,  $vd$ , with the prolongation long, the distal third very slender, with a strong seta at the point of narrowing; rostral spines at near one-third the length of the prolongation, arising from a common basal tubercle. Gonapophyses,  $g$ , with mesal-apical lobe short, strongly curved at tip. *Ædeagus* slender, on outer central portion provided with bulbous setoid structures, much as in *malitiosa*, sp. n. :

*Hab.* Peru (Junin).

*Holotype*, ♂, Huacapistana, Tarma, altitude 3600–5400 feet, March 3, 1940 (*Woytkowski*). *Allotopotype*, ♀, March 10, 1940. *Paratopotype*, 1 ♂, February 29, 1940.

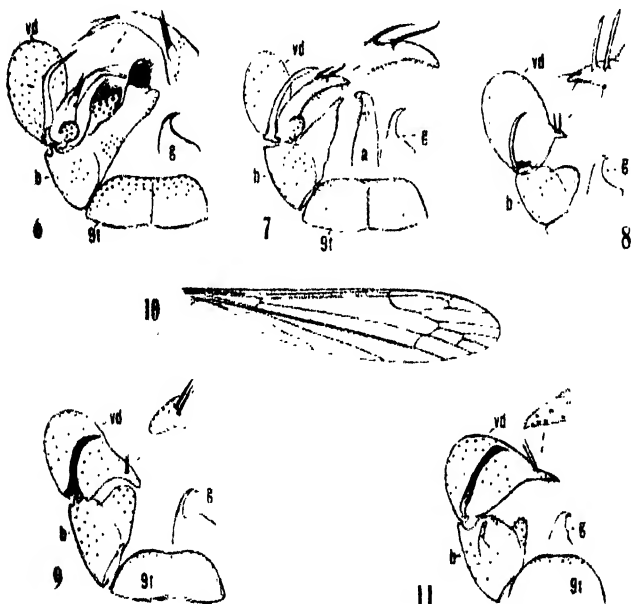
*Limonia* (*Dicranomyia*) *apposita* is quite distinct from other species of the subgenus in South America having



the male hypopygium complex in structure. It is evidently allied to *L. (D.) malitiosa*, sp. n., and *L. (D.) longiventris* (Alexander), yet with the male hypopygium entirely different.

*Limonia (Dicranomyia) malitiosa*, sp. n.

Allied to *longiventris*; general coloration of thorax yellow, unpatterned; halteres and abdomen elongate;



- Fig. 6.—*Limonia (Dicranomyia) apposita*, sp. n.; male hypopygium.  
 Fig. 7.—*Limonia (Dicranomyia) malitiosa*, sp. n.; male hypopygium.  
 Fig. 8.—*Limonia (Dicranomyia) labecula*, sp. n.; male hypopygium.  
 Fig. 9.—*Limonia (Dicranomyia) atrostyla*, sp. n.; male hypopygium.  
 Fig. 10.—*Limonia (Dicranomyia) submutata*, sp. n.; venation.  
 Fig. 11.—The same; male hypopygium.

(Symbols: *a*, aedeagus; *b*, basistyle; *g*, gonapophysis  
*t*, 9th tergite; *vd*, ventral dististyle.)

male hypopygium with the ventro-mesal lobe of basistyle a relatively simple blackened lobe that narrows to the subacute apex; rostral spines from a common plate or

low flange, subappressed: ædeagus toward apex with numerous pale setoid appendages with bulbous ends.

*Male*.—Length about 7.5 mm.; wing 8 mm.

Rostrum yellow; palpi black. Antennæ black, the scape obscure yellow; basal flagellar segments oval, soon passing into elongate-cylindrical, the verticils shorter than the segments. Head ochreous; anterior vertex relatively wide, about twice the diameter of scape.

Thorax uniformly yellow to brownish yellow, unmarked. Halteres very long and slender, black throughout. Legs with the coxæ and trochanters yellow; femora dark brown, the tips very insensibly paler; tibiæ and tarsi brownish black. Wings with a weak brownish tinge, the oval stigma slightly darker brown; veins dark brown. Venation:  $Sc_1$  ending about opposite origin of  $Rs$ ,  $Sc_2$  far from its tip, so that  $Sc_1$  alone exceeds  $Rs$ ;  $m-cu$  near fork of  $M$ .

Abdomen elongate; tergites dark brown, sternites yellow. Male hypopygium (fig. 7) with the tergite,  $9t$ , transverse, the caudal border truncate or nearly so. Basistyle,  $b$ , with the ventro-mesal lobe conspicuous, blackened, narrowed to a subacute tip. Dorsal dististyle a gently curved rod, the tip acute. Ventral dististyle,  $vd$ , dusky, of moderate size, in total area not greatly different from the basistyle; main body of style loosely joined to the rostral prolongation, the latter a gently curved flattened blade bearing the spines at beyond mid-length; spines arising from a common raised plate or flange, subappressed, the outer one more sinuous; a small setiferous lobe on mesal face of prolongation at base. Gonapophyses,  $g$ , with mesal-apical lobe erect, pointed. Ædeagus,  $a$ , toward apex with numerous pale setoid appendages that terminate in small bulbous ends.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huasahuasi, Tarma, altitude 2800 metres, April 10, 1940 (*Woytkowski*).

*Limonia* (*Dicranomyia*) *malitiosa* is still another of rather numerous species that are allied to *L. (D.) longiventris* Alexander, *L. (D.) simillima* Alexander and others, well distinguished from these other forms by the structure of the male hypopygium. The bulbous-tipped setæ of the ædeagus are found in other allied species.

*Limonia (Dicranomyia) labecula*, sp. n.

General coloration uniformly ochreous, without markings; antennæ with scape yellow, the remaining segments dark brown; legs uniformly yellow; wings very pale yellow, the stigmal darkening reduced to a seam along vein  $R_2$ ; a faint dark seam along cord, best evidenced by a deepening in the colour of the veins; cell 1st  $M_2$  open; male hypopygium with the rostral prolongation of the ventral dististyle very small, pointed at tip; rostral spines two, separate at base.

*Male*.—Length about 5.5 mm.; wing 6.5 mm.

Rostrum ochreous, pendant, relatively short; palpi brown. Antennæ with the scape yellow, pedicel and flagellum dark brown; flagellar segments oval, the verticils subequal in length to the segments. Head ochreous yellow; anterior vertex relatively wide, about twice the diameter of the scape.

Thorax uniformly ochreous to reddish ochreous, without markings. Halteres uniformly pale yellow, stem short. Legs uniformly yellow, the terminal three tarsal segments dark brown. Wings with a very pale yellow tinge; stigma reduced to a linear seam on  $R_2$ ; a very narrow and restricted dark seam along cord, indicated especially by the darkened veins; remaining veins pale yellow. Venation:  $Sc_1$  ending a short distance before origin of  $R_s$ ,  $Sc_2$  a great distance from its tip, at near mid-length of cell;  $R_s$  nearly straight, almost three times the arcuated basal section of  $R_{4+5}$ ; cell 1st  $M_2$  open, both  $m$  and the basal section of  $M_3$  atrophied, leaving the distal section of the latter suspended in the membrane; in one wing of the type this last-mentioned element at proximal end curves slightly toward  $M_{3+4}$ , indicating the possibility of normal occurrence of this section of the vein, in which case the cell would be open by the atrophy of  $m$ ; cell 2nd  $A$  wide.

Abdomen yellow, the central portion of tergites narrowly darkened; hypopygium yellow. Male hypopygium (fig. 8) with the basistyle,  $b$ , small, its ventromesal lobe simple. Dorsal dististyle a slender, gently curved blade, very gradually narrowed to an acute point. Ventral dististyle,  $vd$ , fleshy, much more extensive than the basistyle; rostral prolongation very small, termi-

nating in a subacute sclerotized point; rostral spines two, of moderate length, slightly separated at bases. In the unique type, one dististyle shows three such spines, and it cannot be affirmed as to whether this is an abnormal or a variable character. Gonapophyses, *g*, with mesal-apical lobe erect, gently decurved at apex.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huacapistana, Tarma, altitude 3600–5400 ft., March 12, 1940 (Woytkowski).

*Limonia* (*Dicranomyia*) *labecula* is most similar to *L. (D.) aurantiothorax* Alexander, of northern Panama, which differs in the unpatterned wings and in the distinct venation. In the open cell 1st  $M_2$  the present fly resembles the Chilean *L. (D.) cautinensis* Alexander and *L. (D.) flavaperta* Alexander, both differing in all other respects.

*Limonia* (*Dicranomyia*) *atrostyla*, sp. n.

Belongs to the *brevivena* group; general coloration clear grey, the præscutum with four narrow dark brown stripes; antennæ black throughout; wings with basal fourth clear light yellow, the outer portion greyish hyaline; stigma scarcely darker; cell 1st  $M_2$  open by the atrophy of *m*; male hypopygium with the tergite and basistyles black, the ventral dististyle abruptly light yellow, contrasting conspicuously; male hypopygium with apex of rostral prolongation obtusely rounded.

*Male*.—Length about 4–4.5 mm.; wing 5–5.5 mm.

Rostrum black, sparsely pruinose; palpi black. Antennæ black throughout; flagellar segments short-oval, the outer segments passing to long-oval; verticils relatively short. Head dark grey.

Thorax clear grey pruinose, the præscutum with four narrow dark brown stripes, the intermediate pair separated only by a capillary line of the ground; scutal lobes similarly darkened; scutellum and medio-tergite dark, only slightly pruinose. Pleura dark grey. Halteres with stem yellow, knob dark brown. Legs with the coxæ dark brown, the tips restrictedly yellow; trochanters yellow; femora yellow basally, passing into brownish yellow, the tips narrowly dark brown; tibiæ and basitarsi pale brown, the tips narrowly blackened; remainder of tarsi

dark brown. Wings with the basal fourth clear light yellow, including the veins; remainder of disk greyish hyaline, deepest in the apical cells; stigma very pale, scarcely darker than the ground; veins brown except as indicated. Venation:  $Sc$  very short,  $Sc_1$  ending about two-thirds the length of  $R_s$  before the origin of this latter vein,  $Sc_2$  far from its tip;  $R_s$  short and arcuated, about one-fourth longer than the basal section of  $R_{4+5}$ ; cell 1st  $M_2$  open by the atrophy of  $m$ ;  $m-cu$  subequal to the distal section of  $Cu_1$ , close to the fork of  $M$ .

Abdominal tergites brownish black, the colour including the tergite and the basistyles of the male hypopygium, which contrast strikingly with the pale yellow ventral dististyle; basal sternites obscure brownish yellow. Male hypopygium (fig. 9) with the caudal margin of tergite convexly rounded, the extreme median portion a trifle emarginate. Basistyle,  $b$ , small, with large ventromesal lobe. Dorsal dististyle a gently curved rod, the long tip acute. Ventral dististyle,  $vd$ , of moderate size, its area about equal to the total of the basistyle; rostral prolongation stout, its tip obtuse; rostral spines black, subequal in length, slightly separated at bases. Gonapophyses,  $g$ , with mesal-apical lobe long and slender, gently curved.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huacapistana, Tarma, altitude 3800–5400 ft., March 7, 1940 (Woytkowski). *Paratopotype*, ♂, with the type.

The nearest regional allies are *Limonia* (*Dicranomyia*) *ambigua* Alexander, of southern Chile and Patagonia, and *L. (D.) brevivena torrida* Alexander, of the West Indies, both of which differ in the coloration, details of venation, and the structure of the male hypopygium. The abrupt contrast in colour of the basistyle and ventral dististyle of the male hypopygium is quite different from the condition obtaining in the two species listed.

*Limonia (Dicranomyia) submutata*, sp. n.

Belongs to the *tristis* group; general coloration dark grey, the praescutum and the scutal lobes patterned with brown; wings with a weak brown tinge, the stigma a little darker; male hypopygium with the caudal margin

of tergite convexly rounded; basistyle with an elongate finger-like lobe on face of basistyle; ventral dististyle relatively large, the outer margin sloping directly to the nearly acute blackened rostrum.

*Male*.—Length about 5.5–6.5 mm.; wing 6–7 mm.

*Female*.—Length about 6–6.5 mm.; wing 6.5–7 mm.

Rostrum dark grey; palpi black. Antennæ black throughout; flagellar segments oval, the terminal segment considerably larger than the penultimate. Head grey; anterior vertex narrow.

Pronotum and mesonotum dark grey, the præscutum with a more or less distinct brown median stripe, usually broad and conspicuous; lateral stripes less evident; scutal lobes similarly infuscated. Pleura grey; dorso-pleural membrane obscure yellow. Halteres relatively long, stem light yellow, knob dark brown. Legs with the coxæ brownish testaceous, paler apically; trochanters light yellow; remainder of legs dark brown. Wings (fig. 10) with a weak brown tinge, the small short-oval stigma slightly darker brown; veins brown. Venation:  $Sc_1$  ending a short distance beyond origin of  $Rs$ ,  $Sc_2$  near its tip; cell 1st  $M_2$  somewhat variable in length, in cases shorter than vein  $M_{1+2}$  beyond it, in other specimens subequal to or even longer than this vein;  $m-cu$  before fork of  $M$ .

Abdomen brownish black, the hypopygium reddish brown. Male hypopygium (fig. 11) with the caudal margin of tergite convexly rounded. Basistyle,  $b$ , with the finger-like lobe on face elongate; more distally a group of about four setæ from a slightly developed tubercle. Dorsal dististyle a relatively slender blackened rod, the tip an acute spine. Ventral dististyle,  $vd$ , relatively large, the outer margin sloping directly to the nearly acute blackened rostrum; rostral spines separate, but placed very close together, from very small tubercles; spines very slightly unequal in length, the shortest a trifle longer than the rostrum beyond it. Gonapophyses  $g$ , with mesal-apical lobe relatively stout.

*Hab.* Peru (Junin).

*Holotype*, ♂, Satipo, Jauja, altitude 800–900 metres, January 15, 1940 (*Paprazycki*). *Allotopotype*, ♀, pinned with type. *Paratopotypes*, 20 ♂♀, December 31, 1939, to January 20, 1940.

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The nearest regional ally is *Limonia* (*Dicranomyia*) *mutata* Alexander, which differs conspicuously in the structure of the male hypopygium, especially of the ventral dististyle, which has the body very small, the rostral portion correspondingly large and not sloping directly into the margin of the body, as in the present fly. The types of *mutata* were recorded as being from Brazil (Mount Roraima, 1932, J. G. Myers), but recent studies by Phelps \* show that virtually all biological materials hitherto taken on the summit of Roraima were secured on the Venezuelan portion of the mountain, and should be credited to Venezuela.

*Limonia* (*Peripheroptera*) *rediviva*, sp. n.

Size large (wing, male, over 10 mm.); entire body polished black, without pruinosity; antennæ, halteres, and legs black throughout; wings with a strong brownish-yellow tinge, the cells of the basal two-fifths clearer yellow; costal vein and adjoining membrane dark brown;  $R_{1+2}$  jutting beyond level of  $R_2$  and the free tip of  $Sc_2$  as a long spur; inner ends of cells  $R_3$ ,  $R_5$ , and 1st  $M_2$  in transverse alignment.

*Male*.—Length about 7 mm.; wing 10.5 mm.

Rostrum and palpi black. Antennæ black throughout, short; flagellar segments cylindrical, the terminal segment about one-fourth longer than the penultimate; longest verticils considerably exceeding the segments. Head polished black.

Entire thorax polished black, without pruinosity. Halteres black. Legs black throughout. Wings with a strong brownish-yellow tinge, the cells of the basal two-fifths clearer yellow; the incrassated costal vein and adjacent membrane dark brown; stigmal area not differentiated; veins yellow, those comprising the arculus and anterior cord a trifle darker. Venation:  $Sc_1$  ending opposite origin of  $Rs$ ,  $Sc_2$  far from its tip, at near mid-distance to arculus;  $Rs$  gently arcuated, a trifle longer than the basal section of  $R_{4+5}$ ; free tip of  $Sc_2$  and  $R_2$  in transverse alignment or with the former a trifle more

\* Phelps, William H., "The Geographical Status of the Birds collected at Mount Roraima," Biol. Soc. Venezolana Ciencias Naturales xxxvi. pp. 83-95; 6 maps (1938).

basad, with a long spur of  $R_{1+2}$  jutting beyond this point ; inner ends of cells  $R_3$ ,  $R_5$ , and 1st  $M_2$  in transverse alignment ; cell 1st  $M_2$  long and narrow, subequal to vein  $M_{1+2}$  beyond it ;  $m-cu$  more than one-half its length beyond the fork of  $M$  ; prearcular field moderately large ; cell 2nd  $A$  narrow, constricted just beyond the interanal cross-vein.

Abdomen entirely polished black.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huacapistana, Tarma, altitude 3600–5400 ft., March 3, 1940 (*Woytkowski*).

*Limonia* (*Peripheroptera*) *rediviva* is entirely different from the other black-bodied species of large physical size, such as *L. (P.) prindlei* Alexander (Ecuador) and *L. (P.) vivas-berthieri* Alexander (Venezuela). The wing-pattern and venational details readily suffice to distinguish the species.

*Limonia* (*Peripheroptera*) *subamæna*, sp. n.

General coloration dull black ; præscutum yellowish grey, with three polished black stripes that are confluent behind, virtually obliterating the posterior interspaces ; median area of scutum broadly yellowish grey extended caudad on to the base of scutellum ; mediotergite uniformly black ; legs black, the femoral bases narrowly obscure yellow ; wings whitish subhyaline, conspicuously patterned with brown ; cell 1st  $M_2$  unusually long, exceeding vein  $M_{1+2}$  beyond it ; abdomen black, the extreme caudal borders of segments weakly pruinose.

*Female*.—Length about 6.5–7 mm. ; wing 7.5–8 mm.

Rostrum black ; palpi brownish black. Antennæ black throughout ; flagellar segments oval. Head dull black ; anterior vertex relatively wide, about twice the diameter of scape.

Pronotum dull black. Mesonotal præscutum with the ground-colour yellowish grey, with three polished black stripes that are confluent behind, virtually obliterating the posterior interspaces and restricting the ground to the humeral and lateral portions ; scutal lobes polished black, the broad median area yellowish grey, the colour continued caudad on to the base of scutellum ; mediotergite uniformly black. Pleura black ; sternopleurite and meron heavily light grey pruinose ; dorsopleural



membrane dark. Halteres black, the base of stem obscure yellow. Legs with the coxæ and trochanters black; femora black, the bases very narrowly obscure yellow; remainder of legs black. Wings whitish subhyaline, conspicuously patterned with brown, including the stigma, broad seams on cord and outer end of cell 1st  $M_2$ , and a postarcular area in bases of cells  $R$  and  $M$ ; wing-tip less intensely darkened, extending basad almost to the general level of outer end of cell 1st  $M_2$ ; cell 2nd  $A$  extensively infuscated; veins yellowish brown, darker in the clouded areas. Venation:  $Sc_1$  ending opposite origin of  $Rs$ ,  $Sc_2$  only moderately removed from its tip, at near two-thirds the length of vein; cell 1st  $M_2$  very long, much longer than in *peramaena*, exceeding vein  $M_{1+2}$  beyond it.

Abdomen black, the extreme caudal borders of the segments weakly pruinose; genital segment black, the valves of ovipositor horn-coloured.

*Hab.* Peru (Huanuco).

*Holotype*, ♀, Piedras Grandes, altitude 3000 metres, November 26, 1937 (*Woytkowski*). *Paratopotype*, ♀, November 30, 1937.

*Limonia* (*Peripheroptera*) *subamaena* is very similar to *L. (P.) peramaena* Alexander, of Ecuador, differing especially in the details of coloration of the mesonotum and in the wing-venation, as the elongate cell 1st  $M_2$ . In *peramaena* the præscutal black stripes are not confluent behind and the interspaces are distinct to the suture, while the pruinose area of the median scutal region extends caudad over the entire scutellum, further involving the basal half of the mediotergite.

*Limonia* (*Peripheroptera*) *croceibasis*, sp. n.

General coloration of mesonotum grey, the præscutum with three polished black stripes; pleura heavily grey pruinose, the ventral sternopleurite polished black; halteres with stem yellow, knob brownish black; legs black, the femoral bases narrowly deep yellow; wings with the ground colour pale yellow, the prearcular field light yellow; stigmal area of male conspicuously enlarged, brownish yellow, of female of normal size, brown; cord and outer end of cell 1st  $M_2$  narrowly darkened.

*Male*.—Length about 5.5–6.5 mm.; wing 6.5–8.5 mm.

*Female*.—Length about 6–6.5 mm. ; wing 6.2–7 mm.

Rostrum and palpi black. Antennæ black throughout ; flagellar segments oval, the longest verticils a little exceeding the segments ; terminal segment longer than the penultimate, the outer end a little pointed. Head brown, the orbits obscure grey.

Pronotum dull black, grey on sides. Mesonotal præscutum yellowish grey, with three polished black stripes, the median one wider ; scutal lobes extensively blackened ; scutellum black, the surface pruinose ; postnotum pruinose, especially on cephalic and central portions. Pleura heavily grey pruinose, the ventral sternopleurite polished black ; ventral portion of anepisternum a trifle polished. Halteres with stem yellow, knob brownish black. Legs with coxæ black, the surface sparsely pruinose ; trochanters black ; remainder of legs black, the femoral bases narrowly but rather conspicuously deep yellow. Wings with the ground-colour pale yellow ; prearcular field light yellow, more extensive and brighter in male ; stigmal area of male conspicuously enlarged, brownish yellow ; costal border, cord, and outer end of cell 1st  $M_2$  narrowly darkened, especially the cord where the veins are slightly thickened ; in female, stigma of normal size, medium brown ; cord and outer end of cell 1st  $M_2$  narrowly darkened ; veins brown, yellow in the prearcular field. Venation : in male,  $Sc_2$  at or before mid-length of  $Sc$  ; venation in stigmal area variable ; free tip of  $Sc_2$  in cases some distance before  $R_2$ , in other specimens closer to  $R_2$ , with a short spur of  $R_{1+2}$  jutting beyond ;  $Rs$  short ; other elements of cord in approximate transverse alignment ; cell 2nd  $A$  constricted beyond the interanal cross-vein. In female,  $Sc_1$  ends before origin of the short, arcuated  $Rs$  ; stigmal area and prearcular field of the more normal type of *Limonia*.

Abdomen black, the caudal margins of the segments narrowly more pruinose ; hypopygium dark.

*Hab.* Peru (Junin, Huanuco).

*Holotype*, ♂, Carpapata, Tarma, Junin, altitude 2800 metres, May 12, 1940 (*Woytkowski*). *Allotopotype*, ♀, May 9, 1940. *Paratypes*, 1 ♂, 1 ♀, Huasahuasi, Tarma, Junin, altitude 2800 metres, April 10–20, 1940 ; 1 ♂, 1 ♀, Piedras Grandes, Huanuco, altitude 3000 metres, September 18 to November 15, 1937 (*Woytkowski*).

*Limonia* (*Peripheroptera*) *croceibasis* is readily distinguished from other generally similar species by the colour of the body and wings. The most similar forms are *L. (P.) subandina* Alexander, of Argentina, and *L. (P.) angustifasciata* (Alexander), of Venezuela, both of which differ in all details of coloration.

*Limonia* (*Peripheroptera*) *trimelanina*, sp. n.

General coloration of body reddish, with yellow pollen; rostrum obscure yellow; antennæ black throughout; mesonotal præscutum with three polished black areas, the cephalic one involving more than half the entire length of the usual median stripe, the lateral areas smaller; pleura reddish brown; knobs of halteres darkened; femora obscure reddish yellow, the tips blackened; wings with a strong yellow tinge, restrictedly patterned with brown; *Rs* and basal section of  $R_{4+5}$  arcuated; abdominal tergites obscure yellow, with a narrow dark brown median stripe that is interrupted at the posterior border of segments.

*Female*.—Length about 8 mm.; wing 10 mm.

Rostrum obscure yellow; palpi black. Antennæ black throughout; flagellar segments oval to long-oval; terminal segment pointed at apex. Head black, heavily yellowish grey pruinose, the central portion of posterior vertex with a darkened area.

Pronotum reddish. Mesonotal præscutum reddish, with three conspicuous polished black areas, the median one wide and conspicuous, including more than the cephalic half of the stripe, the posterior end paling to reddish; lateral stripes with about the cephalic half blackened, the remainder red; ground areas of præscutum heavily yellow pollinose; posterior sclerites of notum reddish, the scutal lobes a trifle darker; scutellum obscure brownish yellow. Pleura reddish brown, the posterior sclerites and pleurotergite golden yellow pollinose. Halteres with stem yellow, knob dark brown. Legs with coxæ and trochanters reddish yellow; femora obscure reddish yellow, the tips rather narrowly but conspicuously black, on the posterior legs involving about the distal tenth; tibiæ brownish black, the tips and all the

tarsi black. Wings with a strong yellow tinge, restrictedly patterned with brown at arculus, stigma, and, as a very narrow seam, at cord; outer end of cell 1st  $M_2$  not or scarcely darkened; veins brown, more yellowish in the stigmal field, darker at cord. Venation:  $R_s$  and basal section of  $R_{4+5}$  arcuated; free tip of  $Sc_3$  before the level of  $R_2$ ; cell 1st  $M_2$  long, subequal to vein  $M_3$  beyond it;  $m-cu$  just beyond the fork of  $M$ ; cell 2nd  $A$  slightly constricted beyond the interanal cross-vein.

Abdominal tergites obscure yellow, with a narrow dark brown median stripe that is slightly interrupted at the caudal margins of the segments; basal sternites obscure yellow, those of outer half of abdomen darker; genital segment black, the apex reddened; cerci small and slender.

*Hab.* Peru (Junin).

*Holotype*, ♀, Huacapistana, Tarma, altitude 3600–5400 feet, March 4, 1940 (Woytkowski).

*Limonia* (*Peripheroptera*) *trimelania* is closest to *L. (P.) trinigrina* Alexander, of Ecuador, differing in the large size, details of coloration of body and wings, and in the venation. Since the males in the subgenus *Peripheroptera* are invariably larger than the females, the male sex of the present fly should be found to be one of the largest and most striking members of the entire group.

*Limonia* (*Rhipidia*) *juninensis*, sp. n.

Allied to *domestica*; antennal flagellum uniformly darkened; thoracic pleura pale, with two narrow longitudinal dark-coloured stripes; femora yellow, with a relatively narrow, pale brown, subterminal ring; wings with the ground-colour yellow, restrictedly patterned with brown, these areas confined to the vicinity of the veins; stigmal area small;  $m-cu$  some distance before fork of  $M$ ; male hypopygium with the rostral spines elongate.

*Male*.—Length about 5 mm.; wing 5–5.2 mm.; antenna about 1 mm.

*Female*.—Length about 6.5 mm.; wing 5.8 mm.

Rostrum and palpi brownish black. Antennæ black, only the apical pedicels of the flagellar segments obscure yellow; basal flagellar segments in male subpectinately

produced on one face, the outer segments elongate oval; in female, flagellar segments more regularly oval, the subpectinate nature not or but slightly evident. Head dark brownish grey.

Pronotum and ground-colour of mesonotum dark reddish brown, the lateral borders broadly, but gradually paler, more greyish brown, this colour including the broad præscutal margins, the lateral portions of scutal lobes, pleurotergite and lateral portions of mediotergite, together with the thoracic pleura underneath the wing-root; the mesonotum thus shows a darkened median stripe on præscutum, and with the posterior sclerites chiefly dark brown, the median region of scutum and scutellum restrictedly pale. Pleura with the ground-colour pale, with two narrow longitudinal dark brown stripes, the interspaces sometimes darker than the ground. Halteres pale yellow throughout. Legs with coxæ pale yellow, their bases traversed by the ventral dark-coloured pleural stripe, most extensive on fore pair; trochanters yellow; femora obscure yellow, with a relatively narrow pale brown subterminal ring, slightly more extensive than the yellow apex; tibiæ and tarsi yellow, the outer tarsal segments darkened. Wings with the ground-colour yellow, restrictedly patterned with brown, as follows:—Post-arcular: at mid-length of cell *Sc*; origin of *Rs*; fork of *Sc*; stigma; a broken band along cord; outer end of cell 1st  $M_2$ , and conspicuous marginal spots at ends of all longitudinal veins, most extensive on vein 2nd *A*, smallest at tips of veins  $R_{4+5}$  and  $M_{1+2}$ ; stigmal area small, not ocelliform as in *domestica*; veins yellow, dark in the patterned areas. Venation: *m-cu* from one-half to three-fourths its own length before the fork of *M*.

Abdomen obscure brownish yellow, the caudal borders of the segments very vaguely darkened; hypopygium pale. Male hypopygium with the tergite transverse, the caudal margin very gently emarginate. Spines of the rostral prolongation of ventral dististyle very long, approximately equal in length to the entire prolongation, arising close together at near two-thirds the length of the prolongation.

*Hab.* Peru (Junin).

*Holotype*, ♂, Satipo, Jauja, altitude 800-900 metres, December 19, 1939 (*Paprzycki*). *Allotopotype*, ♀. *Paratopotype*, 1 ♂.

*Limonia* (*Rhipidia*) *juninensis* is most similar to *L. (R.) domestica* (Osten Sacken), differing in the small size, uniformly darkened antennæ, distinctive wing-pattern, and in the details of structure of the male hypopygium.

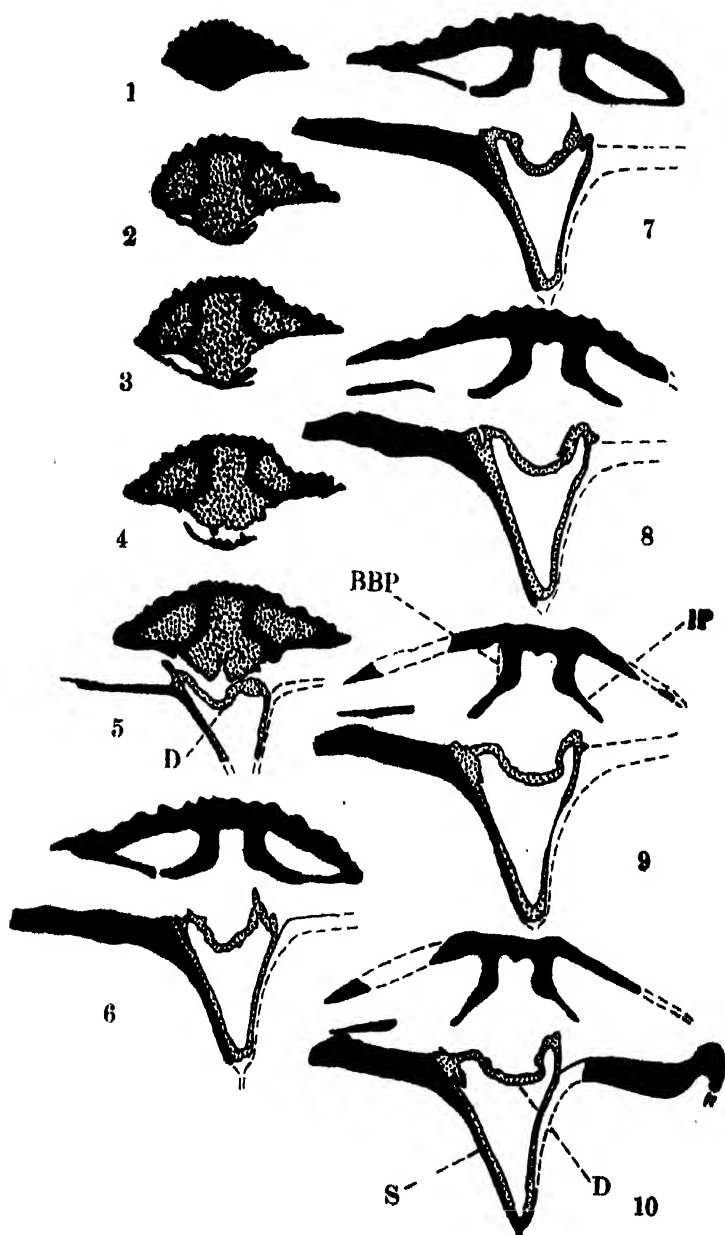
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XXI. *A new Pentamerid Brachiopod Genus from Yass, New South Wales.* By J. K. S. ST.-JOSEPH, Sedgwick Museum, Cambridge.

THE material described in this note was collected from the Hume Series \* at Yass, New South Wales, by Dr. Ida A. Brown, of Sydney University. The specimens which are mostly fragmentary, occur in a matrix of hard limestone, with rough, cariously weathered surfaces. One species only is represented, and that it is a member of the Pentameracea is shown by the strongly biconvex valves, the reduced dentition and the presence of a long, duplex spondylium in the ventral valve. In such characters as the costate surface of the valves and their exaggerated convexity, the prominent ventral umbo and the general arrangement of internal structures the specimens closely resemble the genus *Conchidium*. They differ, however, from this genus and from most other Pentamerids in the prominent curved ventral area, in the long straight hinge-line and the alate outline which many of the specimens possess. The New South Wales Pentamerids were first described in detail by R. Etheridge, jun. (1892), who recorded *Pentamerus australis* (close to *P. oblongus*), a variety of *Barrandella linguifera* and "*P.*" *hospes*, from the Yass district, and *Conchidium knightii* from a number of localities. The structure of some of these Pentamerids has lately been discussed by Booker (1927, pp. 130-146), and the occurrence in this new genus of a well-preserved pseudodeltidium is an interesting addition to the internal structures he describes.

\* For a description of the Hume Series at Yass, see Shearnby, 1912, pp. 114-118.

Fig. 1.



For explanation of the figure see opposite page.

Family **Pentameridae**.**ALICONCHIDIUM**, gen. nov.

*Diagnosis*.—Large, strongly biconvex, gently costate Pentamerid. The ventral valve has a prominent, high, curved area, divided medianly by a delthyrium. The dorsal umbo is rounded and inconspicuous; the hinge-line long and nearly straight. The cardinal extremities of both valves are often considerably produced to give an alate outline (fig. 3). The delthyrium is closed by a pseudodeltidium. In the ventral valve a rather wide spondylium is supported on a long duplex septum. The cardinalia in the dorsal valve are composed of inner-plates and brachial-processes (fig. 1).

Type species: *Aliconchidium yassi*, sp. nov., from the Hume series at Yass, New South Wales.

This new genus agrees closely with *Conchidium*, especially as regards the structural details of the spondylium and septum. The very large curved area and the pronounced alate outline are features which at once distinguish this genus from other Pentameracea that have been described. The area bends away from the hinge-line to the umbo; the length of the hinge-line depending on the prominence of the wing-like extensions of the cardinal angles and often equalling the greatest width of the shell (figs. 2, 3).

The concave pseudodeltidium is generally well preserved, and its occurrence in this species is important in providing one more instance of this structure in the Pentameracea. It may be conjectured that a pseudodeltidium was present generally throughout the group, and that it is mainly because of the delicate nature of the

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*Aliconchidium yassi*, sp. n.

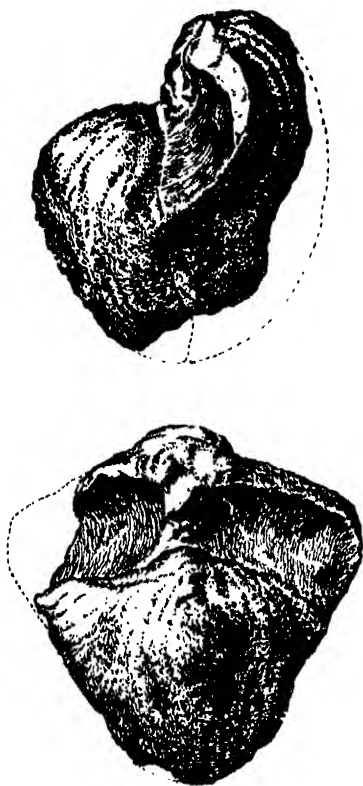
Ten transfers from the posterior end of specimen 6534 c, Geol. Dept. Coll., Sydney University. Hume Series, Yass, N.S.W.  $\times 1\frac{1}{2}$ . The association of this dorsal valve and ventral valve is fortuitous. In drawings 1-5 the extent of the secondary shell-material in the dorsal valve is indicated by stippling: in drawings 5-10 the thin shell-layer which lines the spondylial cavity and also forms the pseudodeltidium is stippled.

BBP = bases of the brachial-processes; D = pseudodeltidium; IP = inner-plates; S = spondylium.



structure, which is easily lost or broken, that it has not been reported more frequently. It agrees in detail with the similar structure in *Pentamerus* (*Pentameroides*) *gottlandicus* (St.-Joseph, 1938, pp. 234-6, text-fig. 1) and

Fig. 2.



*Aliconchidium yassi*, sp. n.

Left lateral and dorsal views of holotype.  $\times \frac{1}{4}$  approx. Specimen 6534a, Geol. Dept. Coll., Sydney University. Bowspring. Limestone Hume Series, near Yass, N.S.W.

*Conchidium biloculare*. The spondylial cavity is lined by a thin layer of shell-substance, which continues across the opening of the delthyrium to form the pseudo-deltidium (figs. 1, 4). This structure would seem to have

formed a sheath round any pedicle rudiment that remained towards the apex of the spondylium. The concave cross-section seen in many specimens is perhaps caused by the incurving of the dorsal umbo, which may arch forward to overlie the delthyrium.

The spondylium is normally V-shaped in section (fig. 1), only occasionally approaching the parallel-sided condition seen in some species of *Conchidium* (fig. 4). There is the usual weak dentition characteristic of the Pentameridae, the upper corners of the spondylium functioning as teeth (fig. 4, VI). In the dorsal valve the cardinalia are embedded in the thick mass of shell-substance below the umbo, as shown in fig. 1, where the extent of this secondary shell-material is indicated by stippling. Two pairs of plates are present, the inner pair bent sharply from the outer. These are analogous to the "inner-plates" and "bases of the brachial-processes" of other Pentamerids, the arrangement agreeing closely, for example, with the dorsal structures of some species of *Stricklandia* (St.-Joseph, 1938, text-fig. 21). Distinct outer-plates have not been noticed, they may be fused with the bases of the brachial-processes or be undifferentiated in the shell-thickening at the posterior end of the valve.

*Aliconchidium yassi*, sp. nov. (Figs. 1-4.)

**Material.**—About thirty specimens (mostly fragmentary) from the collection of the Geology Department of Sydney University.

**Horizon and Locality.**—Bowspring limestone, Hume Series at Limestone Creek, quarter-mile north of "Silverdale" House, between Yass and Bowning, New South Wales. The correspondence with the genus *Conchidium* in the structural grade of so many characters indicates that this form is of about the same age. *Conchidium* is commonest in the Upper Silurian of Sweden, England, and North America, and the Lower Devonian of the Urals; the rather "advanced" features of *Aliconchidium*, e. g., the long, straight hinge-line and the alate shape, suggest a rather late horizon.

**Holotype** (here selected).—Specimen 6534 a, Geol. Dept. Coll., Sydney Univ. (see fig. 2).

*Paratypes*.—Specimens 6534 *b-c*, Geol. Dept. Coll., Sydney Univ. ; A. 10322-27, Sedg. Mus., Cambridge.

This species is perhaps that found by Mitchell in the Lower Limestone at Bowring: "a deeply corrugated *Pentamerus* of triangular shape, that I have not yet identified, and which appears to be typical of this zone." (Mitchell, 1887, p. 1198).

*Diagnosis*.—Largely as for the genus. The valves are very thick and massive. The profile varies from moderately to strongly biconvex; in some of the larger specimens the ventral umbo arches forward above the hinge-

Fig. 3.



*Aliconchidium yassi*, sp. n.

Ventral valve of paratype.  $\times \frac{1}{2}$  approx. Specimen 6534 *b*, Geol. Dept. Coll., Sydney University. Bowspring Limestone, Hume Series, near Yass, N.S.W.

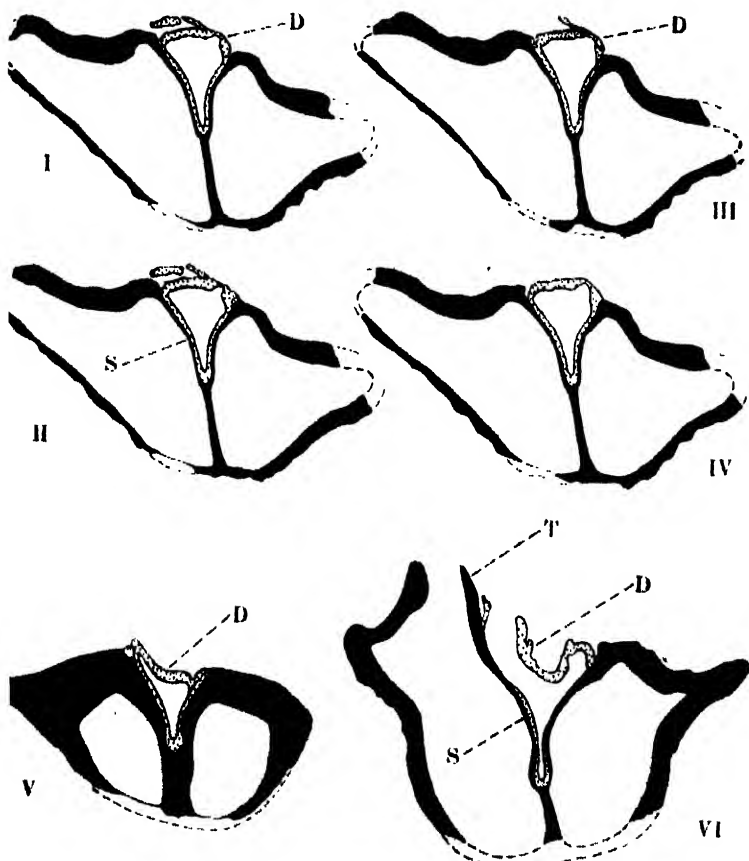
line. The greatest width of the shell is attained in the cardinal region, which is considerably extended in the strongly alate forms. The valve-surfaces carry slight, rounded costæ. The spondylium is approximately triangular in section or with gently curved walls. The septum increases in height anteriorly and continues below the end of the spondylium to the anterior margin of the valve, its duplex character being always clearly marked.

*Dimensions* (in mm.) :—

Length.	Breadth.	Thickness.	
60	62	46	(approx. present dimensions of holotype).
40	64	—	(a ventral valve, incomplete).
43	60	—	( " " " ).

The holotype is a rather gerontic specimen in which the alate outline has been modified owing to growth round the valve-margins. Fig. 3 shows the shape of the ventral valve of typical adult individuals.

Fig. 4.



*Aliconchidium yassi*, sp. n.

I-IV.—Transfers from a ventral valve.  $\times 1\frac{1}{2}$ . Specimen A. 10326. Sedg. Mus., Cambridge. V-VI.—Transverse sections of two ventral valves. Specimens 6534 a-e, Geol. Dept. Coll., Sydney University,  $\times 1\frac{1}{2}$  and  $\times 1\frac{1}{2}$  respectively.

D=pseudodeltidium ; S=spondylium ; T=tooth.

The costæ are largest in the median plane, where a rudimentary fold may be developed in the ventral valve. Four or five costæ occur to the centimetre at the anterior margin. The area is smooth or crossed by fine growth-lines; it is distinctly separated from the rest of the valve. A considerable development of secondary shell-material occurs at the posterior ends of the valves, embedded within which are preserved the early growth stages of the dental-plates forming the septum, and of the cardinalia. Further towards the anterior of the dorsal valve than is shown in the sections in fig. 1, the brachial-processes probably separated from the valve-wall and extended beyond the ends of the inner-plates.

In a number of external characters the species shows the same large range of variation that has been noted in other *Pentameridæ*. The convexity of the valves, incurving of the umbones and the outline of the shell are the least constant characters, and it is interesting to find the same plasticity in these features occurring in different members of this family. In hardly any other *Pentamerid* yet described are the structural details of the pseudo-deltidium so clear as in *Aliconchidium yassi*, and it would seem that throughout the *Pentameracea* the pseudo-deltidium was formed of the thin layer of shell-material lining the spondylium. The whole layer may have been secreted by the mantle lobe sheathing the much reduced pedicle in this group.

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# THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 52. APRIL 1942.

XXII.—*Revisional Notes on the Genus Euploea F.* By  
A. STEVEN CORBET, British Museum (Natural History).

As far as the males are concerned, in any particular habitat, there is usually little difficulty in separating *Euploea* specimens into their respective species; the problem of associating the geographical races of the same species is more involved. An examination of the males has shown the Indo-Malayan species of the genus to be as given in the key on page 259. Although Fruhstorfer (1910-1911, in Seitz, Grossschmett. Erde, ix. pp. 225-278) recognized over 140 different species of *Euploea*, it is doubtful, in fact, if more than 40 species exist.

For the purpose of identifying males of *Euploea* species, the following considerations are important :—

(a) In some species there are one or two sericeous stripes, known as "brands," in space 1 b on the upperside of the forewing. The blue stripe in space 1 b in *E. eleusina*, *E. leucostictos* and *E. dioeletianus* is regarded as a brand, for there is a corresponding sericeous stripe in the same position on the underside.

(b) The design and character of the markings in spaces 1 a and 1 b on the underside of the forewing are highly important. Often there is a stripe in the anterior half of space 1 b, which may be pale and, in some cases, with a blackish brand overlying it, or it may comprise only

a dark sericeous stripe. The whole of space 1 *a*, and usually some portion also of space 1 *b*, is pale and rather shining, and different in appearance from the rest of the wing. In some species there is a prominent thickened patch of pale scales below the stripe in space 1 *b* and occupying an area in the centre of spaces 1 *a* and 1 *b*.

(c) The forewing dorsum may be almost straight, curved or bowed, and in some species the dorsum varies according to the habitat.

(d) In the costal region of the upperside of the hindwing is a pale nacreous area of varying extent but confined to spaces 7 and 8 in all species except *E. cleusina*. In many species, in the anterior half of the hindwing and below the pale nacreous area, is a large oval and slightly shining area termed the *speculum*; it is paler than the rest of the wing and contains the androconial scales. In some groups there is, on the speculum, a prominent, raised, coloured patch of scales which is usually pale yellow (yellowish buff in *E. gamelia* and white in *E. diocletianus*), and situated in or extends into the cell.

The above-mentioned secondary sexual characters are liable to some modification on passing from one geographical sub-region to another.

In the forewing cell, in both sexes, a *recurrent vein* from the discoidals is present in some species.

Only in *E. doubledayi* and *E. mulciber* are the androconial scales distinctive. In a majority of species, the male genitalia exhibit little differentiation, but *E. doubledayi*, *E. cleusina*, *E. phænareta*, *E. klugii*, *E. leucostictos* and *E. diocletianus* are distinctive in this respect.

The larvæ of *E. core asela* Mre. from Ceylon, *amymone* (Godt.) from Hong Kong and *corinna* (W. S. MacLeay) from Australia are similar, as are those of *E. midamus midamus* (L.) from Hong Kong and *ochsenheimeri* Luc. from Java. On the other hand the larva of *E. klugii kollari* C. & R. Feld. from South India is quite different from that of *E. leucostictos leucostictos* (Gmelin) from Java, although it has been suggested that these are races of a single species.

The genus *Euploea* is remarkable for the great similarity in facies shown by different species flying in the same habitat. Leaving aside the rather specialized species

*E. crameri*, *E. phænareta* and *E. dioctetianus*, the remaining three Ceylonese species exhibit the same "core"-like facies; as a rule, species from Sikkim and Assam are highly blue-glossed and rather "mulciber"-like in appearance, while Burmese forms have usually a double series of white submarginal spots on the hindwing, a character which, together with the blue gloss, tends to disappear in Neomalaya (*i. e.* Malaya, Sumatra and Borneo). Some of the races from Paramalaya (*i. e.* the islands off the west coast of Sumatra) show obsolescence of the white spots; representatives from Java and the islands as far as Sumba are smaller in size and rather drab in appearance; Luzon forms have large white subapical markings on the forewing and are often blue-glossed. The Celebesian races are larger, with prominent white discal and/or post-discal white spots. Moluccan races are darker, with reduced or obsolete markings, and representatives from New Guinea are rather similar. Forms from islands of the Timor group are remarkable for the rather falcate forewing and the greatly increased white spotting; representatives from Australia are similar to the corresponding forms from New Guinea or Timor and, in the case of *E. tulliolus*, it is evident that Australia has been colonised by forms from both Timor and New Guinea, which now fly together in some districts and apparently do not interbreed. The occurrence of two "species" of the same species-complex in the same habitat makes the question of nomenclature somewhat involved, and particularly so in the case of the *E. tulliolus*-complex where two distinct forms occur together, and apparently behave as distinct species, in the Sula Islands, New Guinea and Australia.\*

\* The following arrangement of the *E. tulliolus* species-complex is suggested:—

- 1 (6). Upperside hindwing with white submarginal spots small or obsolete.
- 2 (5). Upperside forewing apical half of wing blue or purple-blue glossed, and with white or pale violaceous submarginal spots.
- 3 (4). Upperside forewing lacking a large white spot at the base of space 2 in both sexes *E. tulliolus* (F.), 1793.  
(Distribution and races as given in key to the genus on p. 264.)
4. Upperside forewing with a large white spot at the base of space 2 in both sexes *E. howitsonii* C. & R. [Feld., 1865.]



There are other instances of an overlap in the distribution of widely ranging *Euplœa* species, and the most instructive of these is that of the *E. doubledayi*-complex. In the Malay Peninsula are two quite distinct forms of this species-complex known as *evalida* (Swinh.) and *gardineri* Fruh. These can be separated at sight, the first-named being larger, with a darker forewing and, in the female, with white discal spots on the forewing. No intermediates are known and there is no overlap as regards the length of the forewing. (Mean length ♂ forewing of Malayan *evalida* = 50.5 mm. (10 specimens); mean length ♂ forewing of Malayan *gardineri* = 42.2 mm. (27 specimens).  $\Sigma(\bar{x} - x)^2$  for *evalida* = 52.50;  $\Sigma(\bar{x} - x)^2$  for *gardineri* = 99.48. Between the means,  $t = 10.76$ ,  $n_1 + n_2 = 35$ ,  $P < .01$ . Difference between means highly significant, *vide* Fisher, 'Statistical Methods for Research Workers'. It is well known that geographical races differ, almost invariably, by a large number of genetical factors, so that interbreeding between such races produces a series of intermediate forms. The absence of such intermediates between *evalida* and *gardineri* in the Malay Peninsula strongly suggests that no interbreeding occurs and that the two forms are now behaving as distinct specific entities. The Burmese representative of the *E. doubledayi*-complex resembles *evalida*, while the Malaysian series of races show close affinities with *gardineri*. In this case, the occurrence of *evalida* and *gardineri* together in the Peninsula admits of a ready explanation. It has long been established that the present

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(Celebes and Sula Islands. Races are *hewitsonii* C. & R. Feld. (= *hyacinthus* Btlr.), Celebes; *besinensis* Fruh., Sula Besi; *mangolina* Fruh., Sula Mangoli.)

5. Smaller. Upperside forewing dark brown (light brown or whitish violet in some forms), with much reduced spotting ..... [Feld., 1865. *E. stephensii* C. & R.

(Moluccas, New Guinea, and Bismarck Archipelago. Races are *salabanda* Kirsch, Halmaheira; *stephensii* C. & R. Feld., Mysol; *pumila* Btlr., New Guinea; *bismarckiana* Fruh., Lauenburg.)

6. Upperside hindwing with large white submarginal spots or a broad white submarginal border ..... [MacLeay, 1826. *E. darchia* (W. S.

(Timor group and Australia. Races are *hopfferi* C. & R. Feld., Aru; *arise* C. & R. Feld. (= *hymens* Btlr.), Timor; *visenda* Btlr., Timor Laut; *darchia* (W. S. MacLeay), Darwin; *niveata* Btlr., J133 nalan

Peninsula was repeatedly connected with Sumatra and Borneo and it is pretty certain that, on more than one occasion, it was severed from the Asiatic mainland in the neighbourhood of northern Malaya and/or Peninsular Siam. It would appear that Malaya was first populated by the Malaysian *gardineri* at a time when it was separated from the mainland, while the union of Malaya and Peninsular Siam was followed by colonisation by the *evalida* form from the north. Apparently, this southern infiltration is still in progress for *evalida* is not yet known south of the state of Selangor; at the same time, *gardineri* has penetrated into Siam, where it is known as *æsatia* Fruh. (vide Corbet, 1941, Proc. R. ent. Soc. Lond. (A), xvi, 101 & Zeuner, 1941, *loc. cit.* 117).

In this instance the question of nomenclature presents no particular difficulty. The oldest name for the species-complex is *doubledayi* C. & R. Feld., described from North India, and clearly this must be applied to the Indian and Burmese species and its Malayan representative *evalida*. The oldest name for the remaining Malaysian forms is *eyndhovii* C. & R. Feld., described from Java, and this can be employed for the Malaysian species of the complex.

A parallel case is presented by the two forms of the *swainson*-complex in Palawan, an island forming a link between Malaysia and the Philippine Islands and whose fauna is mainly Malaysian, although some Philippine forms are also present. The form *butra* Stgr. is probably the more recent arrival and is closely allied to the Philippine group of races, while *cyllene* Stgr. resembles the Malaysian forms. The quite extensive material in the British Museum shows no evidence of the existence of intermediate forms which suggests that *butra* and *cyllene* are now functioning as distinct species. It seems best to reserve the name *swainson* (Godt.) for the species comprising the Philippine races and Palawan *butra*, and to employ *eleutho* (Godt.) for the remaining forms in this widely distributed species-complex. On passing from Malaysia, to the Lesser Sunda Islands, to the Celebes and the Philippines, no sharp break in the appearance of the forms occurs, and it is evident that any boundary drawn between *eleutho* and *swainson* in the east must be largely an arbitrary one.

It was a common practice of the older authors to describe *Euploea* forms from incorrect localities and this

has led to endless confusion and, in some measure, has been responsible for the present chaotic condition of the genus.

In the following key, the range of the species and the more important subspecies are given, the latter being selected so that the distribution of the species can be followed in Seitz. A few necessary notes on nomenclature may be added here :

(i.) Talbot and Le Cerf (1925, Enc. ent. (B) i. p. 37) found the type specimen (sex not stated) of *E. algea* (Godt.), 1819, Amboina, to be identical with *duponchelii* Bsdv. (i. e. an *eleutho* form). The original description of Godart's species, however, applies to a *climena* and not an *eleutho* form from Amboina. Mr. G. Talbot has kindly allowed me to say he is in agreement with this view.

(ii.) The correct citation of the name *eleutho* is *Danaüs eleutho* Godart, 1824, Enc. méth., ix, p. 815 ; ♂, Guam, and not as usually given. The plate depicting this insect in Freycinet, ' Voyage autour Monde . . . Zoologie ', pl. 83, fig. 2, could not have been published in 1815 as the voyage took place between 1817 and 1820. Even if the plate were published before 1824, the names on it would be invalid under the International Code as they are in French and not Latin.

(iii.) Fruhstorfer (1910, in Seitz, Grossschmett. Erde, ix, p. 240) considered that the name *baudiniana* (Godt.), 1819, probably referred to the Timorese form *E. eleutho orope* Bsdv., although he regarded *E. sylvester timora* Fruh. as a further possibility. I hardly think that Godart's description can be applied to *orope* Bsdv. ; *timora* Fruh., is a better choice, but not an entirely satisfactory one.

(iv.) Some authors have suggested that *helcita* Bsdv., from New Caledonia (type in B.M.), is conspecific with *eleutho* (Godt.). This is quite incorrect, *helcita* representing an eastern extension of *E. climena* (Stoll).

(v.) The name *alcathoe* (Godt.) refers to *E. alecto melancholica* Btlr., from Amboina, and not to *E. eyndhovii eyndhovii* C. & R. Feld., from Java, as is usually supposed, a fact pointed out by Snellen fifty years ago ! (Vide Snellen, 1891, Tijds. Ent. xxxv. p. 1 ; and Grimshaw, 1897, Trans. R. Soc. Edin., xxxix, p. 3).

*Key for the Separation of Males of the Indo-Malayan Species of Euploea F.*

- 1 (19). Upperside hindwing without a prominent white or pale yellow raised patch in or extending into the cell.
- (9). Upperside forewing without a brand (but see *E. core simulatrix* W. M. & Nic.). Forewing cell with a recurrent vein.

*climena* Group (=subgenus *Vonana* Mre.).

- 3 (4). Forewing dorsum almost straight. Underside forewing with whole of space 1 *a* and often posterior edge and distal area of space 1 *b* strongly whitened; in eastern races often a narrow elongate pale stripe in anterior half of space 1 *b* (fig. 1). Upperside usually unmarked, except for a small white spot near the base of space 3 on the forewing in some races; outer areas of both wings paler. . . . . *E. climena* (Stoll), 1782.

(Engano, Java to Timor group, Moluccas, and eastwards. Races are *climena* (Stoll), Amboina; *palmedo* Doh., Sumba; *compta* Rôb., Timor Laur.)

4. Forewing dorsum strongly bowed.
- 5 (8). Underside forewing with one or two sex stripes in space 1 *b*. Forewing < 45 mm.
- 6 (7). Underside forewing with a single pale, narrow, elongate stripe in the anterior half of space 1 *b*; the centre of the posterior half of space 1 *b* and anterior half of space 1 *a* with a prominent, pale yellow specialised area (greyish-buff in Java, and more easterly localities) (fig. 2). Upperside hindwing with a pale yellow raised streak above the cell (obsolete in Java and more easterly localities). Underside hindwing with a thick, dark patch visible by transmitted light . . . . . *E. modesta* Btlr. 1866.

(Burma and Siam, through Malaysia (except Palawan) and the Lesser Sunda Islands to New Guinea. Races are *modesta* Btlr., Siam; *buxtoni* Mre., "Sumatra" [agrees Central Siam]; *ainosæ* Bryk (= *moorei* Btlr. nec C. & R. Feld.), Sumatra; *lorzæ* (Mre.) (= *brookei* Mre., syn. nov.), Borneo; *tenggerensis* Fruh. (= *lamos* Fruh.), East Java; *deheeri* Doh., Sumbawa; *lugens* Btlr., New Guinea.)

7. Underside forewing with two moderately long and broad blackish sex stripes in space 1 *b*, the two arranged to form a parallelogram, with the anterior distal edge nearer the termen; otherwise posterior half of space 1 *b* and whole of space 1 *a* greyish white (fig. 3) ..... *E. crameri* Luc., 1853.

(Burma, Siam and Malaysia (except Palawan). Races are *crameri* Luc., "Manille" [Borneo]: *oceanis* Doh., Engano.)

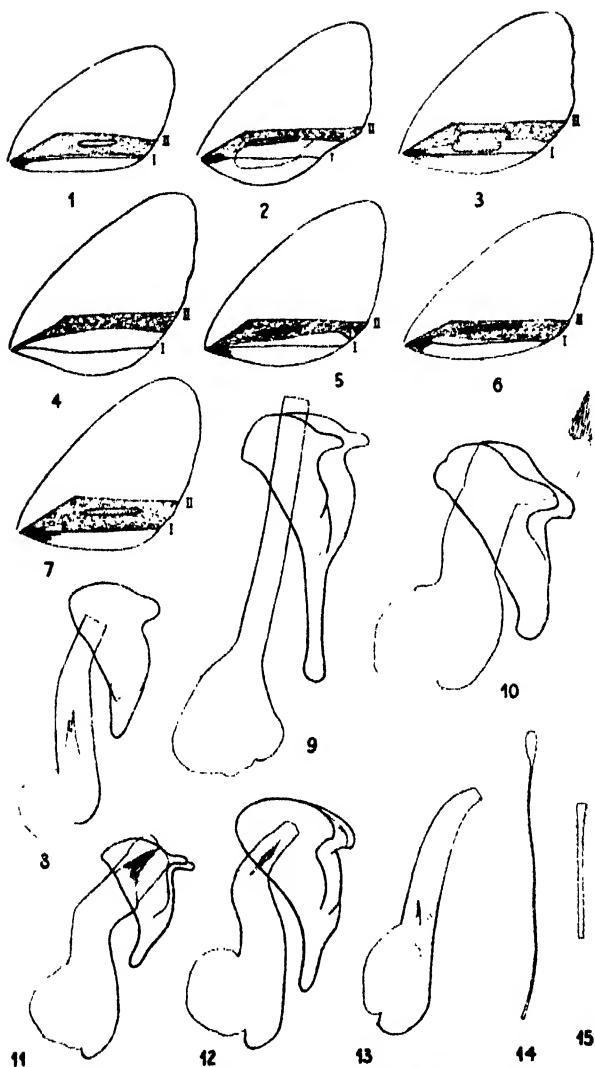
8. Underside forewing without a sex stripe; posterior half of space 1 *b* and whole of space 1 *a* paler than the rest of the wing (fig. 4). Forewing > 45 mm. .... [1865.  
*E. leachii* C. & R. Feld.,

(Burma and Siam, to Malaysia and the Moluccas. Races are *camaralzeman* Bltr., Siam; *malayica* Bltr., Malaya; *cratis* Bltr., Luzon; *leachii* C. & R. Feld., 1865, Celebes; *spiculifera* (Mre.), Buru.)

- 9 (16). Upperside forewing with a single brand in space 1 *b*. Forewing cell recurrent vein present or absent.  
10 (15). Upperside forewing brand dark or greyish brown.  
Upperside hindwing costal nacreous area not reaching vein 6. Forewing cell with recurrent vein.

*core* Group (= subgenus *Crastia* Hbn.).

- 11 (14). Upperside hindwing costal nacreous area not reaching the subcostal vein between base and origin of vein 7.  
Upperside hindwing cell-area not blackened, and with the usual *Euploea* androconial scales.  
12 (13). Upperside forewing brand usually short and always narrow, not reaching to below the origin of vein 2.  
Underside forewing with a pale, elongate narrow stripe in the anterior half of space 1 *b*, on which is superimposed a blackish stripe which usually almost covers the pale stripe (the blackish stripe obsolete in the race *simulatrix* W. M. & Nic., from Great Nicobar, which has no brand on upperside); posterior half of space 1 *b* and whole of space 1 *a* shining greyish white (fig. 5). Forewing dorsum almost straight in Ceylon and India, bowed in Burma, Siam and Malaysia, and strongly bowed in Andamans and Nicobars . *E. core* (Cram.), 1780.



Underside of forewing showing pattern in spaces 1a and 1b in (1) *Euploea climenia climenia* (Stoll), Amboina; (2) *E. modesta modesta* Btlr., Mergui; (3) *E. crameri crameri* Luc., Borneo; (4) *E. leachii malayica* Btlr., Malaya; (5) *E. core godartii* Luc., Burma; (6) *E. eleutho epiphaneia* Fruh., Sumatra; (7) *E. doubledayi doubledayi* C. & R. Feld., Burma. Male genitalia of (8) *E. dioctetianus dioctetianus* (F.), Assam; (9) *E. doubledayi doubledayi* C. & R. Feld., Burma; (10) *E. phanareta butleri* Mre., North Borneo (vesica everted); (11) *E. eleusina eleusina* (Cram.), Java; (12) *E. khugii erichsonii* C. & R. Feld., Burma; (13) *E. leucostictos leucostictos* (Gmel.), Java (aedeagus only). Male androconial scale of (14) *E. mulciber mulciber* (Cram.), Malaya; (15) *E. doubledayi doubledayi* C. & R. Feld., Burma.

(Ceylon and South India to North India, China, Malaya, Sumatra, Java, and eastwards. Races are *core* (Cram.), South India; *andamanensis* Atkinson, Andaman Islands; *scherzeri* C. Feld., "Ceylon" [Car Nicobar]; *simulatrix* W. M. & Nic., Great Nicobar; *godartii* Luc., "Java" [probably Siam]; *wheeleri* Talb., Peninsular Siam (also North Malaya); *amymone* (Godt.), "Amboina" [South-east China]; *distantii* (Mre.), North-east Sumatra; *renominata* Bryk (= *inconspicua* (Mre.)), South-west Sumatra; *mazares* Dbl. (= *haworthii* Luc.), Java; *corinna* (W. S. MacLeay), Cape York, Australia. \*)

13. Upperside forewing brand very long and moderately broad, with basal end extending at least to under origin of vein 2; in some races the brand is slightly concave towards the dorsum. Underside forewing whole of space 1 b darkened, except the anterior edge of vein 1 (fig. 6). Forewing dorsum curved ..... [1824, complex. *E. swainson* (Godt.),

(North India and Siam, throughout Malaysia, to the Philippines and eastwards. Races of *E. eleutho* are *deione* Westw., Assam; *cyllene* Stgr., Palawan; *horsfieldii* C. & R. Feld. (= *diana* Btlr.), Celebes; *duponchelii* Bsdv., Buru; *eleutho* (Godt.), Guam. Races of *E. swainson* are *butra* Stgr., Palawan; *swainson* (Godt.), "Indes orientales" [Philippines].)

14. Upperside hindwing costal nacreous area extending to the subcostal vein between base and origin of vein 7. Upperside hindwing cell-area strongly blackened and containing long, narrow, wedge-shaped androconial scales, with edges haired (fig. 15). Upperside forewing brand long and narrow, not usually extending to below the origin of vein 2. Underside forewing with the whole of space 1 b darkened (fig. 7). Forewing dorsum curved. Upperside forewing dark, velvety brown, unmarked; upperside hindwing submarginal spots prolonged to streaks. Male genitalia (fig. 9) ..... [Feld., 1865, complex. *E. doubledayi* C. & R.

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\* A male in the Hope Department, University Museum, Oxford, from Bali (Hills above N.W. coast, 1, iii. 1936, *Rev. A. Dalby*), and to which the description of *Euploea eleutho casti* Kalis applies, cannot be separated from *E. core corinna* (W. S. MacLeay) from Queensland.

(North India, Siam and throughout Malaysia. Races of *E. doubledayi* are *doubledayi* C. & R. Feld., Assam; *valida* (Swinh.) (= *monticola* Moul.), North Malaya. Races of *E. eyndhovii* are *asatia* Fruh., Siam; *gardinieri* Fruh., Malaya; *eyndhovii* C. & R. Feld. (= *alcathoe* auctt. nec Godt.), Java. *E. tobleri* Semp., Luzon, and of which *snelleni* (Mre.), Mindanao, appears to be a race, lacks the distinctive androconia on the hindwing.)

*eleusina* Group (=subgenus *Selinda* Mre.).

15. Upperside forewing brand pale bluish white, moderately long and narrow. Upperside hindwing costal nacreous area extending into space 5. Upperside forewing with pale bluish white submarginal spots. Forewing cell without recurrent vein. Male genitalia (fig. 11) ..... *E. eleusina* (Cram.), [1780.

(Java and Celebes. Races are *eleusina* (Cram.), Java; *mniszecii* C. & R. Feld. Celebes.)

16. Upperside forewing with two brands in space 1 b. Forewing cell with recurrent vein.

*sylvester* Group (=subgenus *Stictoploea* Btlr.).

- 17 (18). Upperside forewing with anterior brand nearly as long as posterior brand. Forewing dorsum nearly straight. Upperside hindwing without an extensive buff speculum in costal half of wing ..... *E. sylvester* (F.), 1793.

(Ceylon to North India, Indo-China, and throughout the Malay Archipelago to New Guinea and Australia. Races are *coreta* (Godt.), "Indes orientales" [South India]; *harrisii* C. & R. Feld., Cochinchina; *lacordairei* Mre., Java; *laetifica* Btlr. (= *dufresne* auctt. nec Godt.), Philippines; *schlegelii* C. & R. Feld., Celebes; *doleschallii* C. Feld., New Guinea; *sylvester* (F.), Australia.)

*martini* Group.

18. Upperside forewing with anterior brand much shorter and narrower than posterior brand. Forewing strongly bowed. Upperside hindwing with a shining buff speculum extending from below the costal



nacreous area to the upper portion  
of the cell..... *E. martinii* Nic., 1893.

(Sumatra only. Races are *martinii* Nic., North-east Sumatra; *astrana* Fruh., West Sumatra.)

19. Upperside hindwing with a prominent, pale yellow or white raised patch in or extending into the cell (this patch yellowish buff in *E. gamelia*).

- 20 (25). Upper forewing without a brand.

*muliber* Group (=subgenus *Trepsichrois* Hbn.).

- 21 (22). Upperside hindwing with a small, pale yellow, wedge-shaped, raised patch confined to anterior portion of cell. Forewing dorsum not strongly bowed. Upperside hindwing speculum with long club-shaped androconial scales, with edges strongly haired (fig. 14). Forewing cell with recurrent vein..... *E. muliber* (Cram.), [1777.

(South India to North India, Indo-China, Malaysia, Philippines and Celebes. Races are *mulciber* (Cram.), South-east China; *dufresne* (Godt.) (= *diocletia* (Geyer), *megilla* Erichs.), Luzon; *gelderii* Snell., Flores; *euctemon* Hew., Celebes. *euctemon* lacks the long androconial scales.)

22. Upperside hindwing pale yellow, raised patch larger and not confined to cell, and with usual *Euploea* androconial scales. Forewing dorsum strongly bowed. Forewing cell without recurrent vein.

*tulliolus* Group (=subgenus *Calliplœa* Btlr.)

- 23 (24). Upperside hindwing raised patch not extending below middle of cell. Forewing < 40 mm. Genitalia normal. [1793, complex. *E. tulliolus* (F.),

(South Burma and Siam, through the Malay Archipelago (except Paramalaya) to New Guinea, Australia and eastwards. Races of *E. tulliolus* are *koxinga* Fruh. Formosa; *hainana* (Holl.), Hainan; *usurpata* Hulst. (= *mazares* Mre. nec Dbl.), Java; *tulliolus* (Fab.) Queensland. See key on page for other forms of the *E. tulliolus* complex.)

*phænareta* Group (=subgenus *Euploea* F.).

24. Upperside hindwing raised patch extending to within 1 or 2 mm. of submedian vein. Forewing >45 mm. Saccus and aedeagus remarkably short (fig. 10) ..... *E. phænareta* [(Schaller), 1785.]

(Ceylon, Burma and Siam, throughout the Malay Archipelago (except the Timor group) to New Guinea and eastwards. Races are *corus* (Fab.), Ceylon; *castelnau* C. & R. Feld. (= *phæbus* Btlr.), Malaya; *phænareta* (Schaller), Amboina.)

25. Upperside forewing with a single brand in space 1b. Forewing dorsum strongly bowed.

*gamelia* Group (=subgenus *Anadara* Mre.).

- 26 (27). Upperside hindwing with a yellowish buff, lenticular raised patch confined to the anterior portion of the cell. Upperside forewing brand short and broad. Forewing cell with recurrent vein. .... *E. gamelia* (Hbn.), [[1825].]

(Java only.)

27. Upperside hindwing with pale yellow (or white) raised patch not confined to cell. Forewing cell without recurrent vein.

*midamus* Group (=subgenus *Salpinx* Mre.).

- 28 (33). Upperside forewing with distal end of cell not broadly whitened.  
29 (30). Upperside forewing brand long and narrow, with basal end almost under origin of vein 2. Clasper with distal edge excavated; aedeagus curved .. *E. midamus* (L.), 1758.

(Sikkim to Indo-China, Malaysia and the Philippines. Races are *midamus* (L.), South-east China; *roepstorffi* (Mre.), Andaman Islands; *ochsenheimeri* Luc., Java; *simillima* Mre., Luzon.)

30. Upperside forewing brand shorter, broader and lenticular, with basal end far removed from origin of vein 2. Clasper with distal edge convex.  
31 (32). Upperside forewing brand usually only slightly paler than ground. Aedeagus sharply bent about one third from distal end (fig. 12). Upperside forewing marginal spots always present; submarginal spots usually white, violet-tinged in some races .. *E. klugii* Mre., 1857.

(Ceylon and South India to Sikkim, Indo-China and North Malaya. Races are *klugii* Mre., North India;

*minorata* (Mre.) (= *negleyana* (Holl.)). Hainan; *erichsonii* C. & R. Feld. "India septentrionalis, Cochin" (= *crassa* Btlr., Siam.).

32. Upperside forewing brand pale bluish white. Aedeagus curved (fig. 13). Upperside forewing usually without marginal spots; submarginal spots pale blue in Indo-Malayan races. . . . *E. leucostictos* (Gmelin), [1790.

(Burma and Indo-China, throughout the Malay Archipelago (? except the Timor group). Races are *leucostictos* (Gmelin), Java; *westwoodii* C. & R. Feld. (= *viola* Btlr.), Celebes; *nemertes* (Hbn.), Amboina.)

33. Upperside forewing with distal end of cell broadly whitened. Upperside forewing brand pale blue, rather short and ovate. Male genitalia (fig. 8). . . . . *E. diocletianus* (F.), [1793.

(Sikkim to Siam, Malaysia and Celebes. Races are *ramsayi* (Mre.). Nepal: *diocletianus* (Fab.) "India "India orientalis" [Peninsular Siam or Malaya]; *eupator* Hew., Celebes.)

From an examination of the male secondary sexual characters, it appears to me that the remaining *Euploea* species are as listed below, and this arrangement has been adopted at the British Museum. The arrangement can only be regarded as tentative, however, pending an investigation of the male genitalia. Some uncertainty exists regarding the status of *boisduvalii*, *melanopa*, *eurianassa* and *dalmanii*.

#### *climena* Group.

*goudotii* Bsdv., 1833 (Réunion), *euphon* (F.), 1798 (Mauritius) and *desjardinsii* (Guér.), (Rodriguey) 1844, may prove to be conspecific. *helcia* Bsdv., 1859 (New Hebrides to Cook Is.); *latifasciata* Weym., 1885 (Celebes); *nubaida* (Gr. Sm.), 1895, and of which *radica* Fruh. is a race (Moluccas); *eboraci* (Gr. Sm.), 1894 (Bismarck Archipelago); *wallacei* C. Feld., 1860, remarkable for the row of hairs along vein 1 on the upperside of the hindwing (Moluccas to New Guinea); *batesii* C. & R. Feld., 1865 (Moluccas to Solomon Is.); *honestia* (Btlr.), 1882 (Solomon Is.); *alcathoe* (Godt.), 1819, male with speculum blackened and with specialized androconial scales as in *doubledayi* (Moluccas to Australia and New Guinea).

core Group.

*lacon* (Gr. Sm.), 1894 (Biak and New Britain); *magou* Mart., 1912 (Celebes); *dentiplaga* Rothsch., 1915 (Ceram); *nechos* Mathew, 1887 (Solomon Is.); *mitra* Mre., 1857 (Seychelles); *tobleri* Semp., 1878 (Philippines); *boisduvalii* Luc., 1853, of which *fraudulenta* Btlr. is a form and *proserpina* Btlr. a race (Solomon Is., New Hebrides and Fiji Is.); *melanopa* Röh., 1887, and *eurianassa* Hew., 1858, may be conspecific (both from New Guinea); *dalmanii* C. & R. Feld., 1865 (Moluccas to New Guinea). The last four species have the hindwing speculum blackened and with specialized androconial scales as in *doubledayi*.

*multiciber* Group.

*albicosta* Joicey & Noakes, 1916 (Biak).

*treitschkei* Group.

*treitschkei* Bsdv., 1832 (New Guinea to Bismarck Archipelago and New Caledonia).

*eleusina* Group.

*asyllus* Godm. & Salv., 1888 (Solomon Is.).

*midamus* Group.

*usipetes* Hew., 1858, pertains to the *leucostictos* complex (Aru Is., Australia, New Guinea and Bismarck Archipelago).

XXIII.—*Spolia Mentawiensis*: *Rhopalocera*, Danaidæ.  
By A. STEVEN CORBET, British Museum (Natural History).

THE butterflies dealt with in this paper form part of a collection made in the Mentawi Islands in 1924 by Messrs. C. Boden Kloss and N. Smedley; the few specimens taken by Dr. H. H. Karny, who visited the Islands at the same time, are placed in brackets.

*Danaus chrysippus chrysippus* (L.). Pulau Tello, ♂.

The specimen, which is of the form *alcippoides* (Mre.), agrees with specimens of the same form from Nias, where both this form and form *bataviana* (Mre.) occur.

*Danaus melanippus keteus* (Hagen). Siberut, 71 ♂♂, 17 ♀♀ (3 ♂♂, 2 ♀♀); Sipora, 21 ♂♂, 11 ♀♀; North Pagi Is., ♂, ♀.

Of *keteus*, Hagen (1902, Abh. Senckenb. Naturforsch. Ges. xx. p. 322) recorded 150 examples from the Mentawi Islands, and he mentioned also a single male of the Sumatran subspecies *hegesippus* (Cram.), this latter specimen being darker than typical examples from Sumatra or Singapore.

*Danaus melanippus umbrosus* (Fruh.). Pulau Tello, ♀.

*Danaus melanippus hegesippus* (Cram.). Padang, 7 ♂♂, ♀.

*Danaus aspasia viridana*, subsp. n. Siberut, 10 ♂♂, ♀; Sipora, 5 ♂♂, 10 ♀♀ (♀).

Differs from subspecies *kheili* (Stgr.), from Nias, and from subspecies *chrysea* (Doh.), from Engano, in the greenish tinge of the yellow markings, which are hardly less intense on the forewing than on the hindwing. Quite distinct from subspecies *caulonia* (Fruh.), from the Batu Islands, in which the hyaline spots in the apical half of the forewing are not pigmented. Forewing 38 mm. in male holotype; 40 mm. in female allotype. Both types from Sipora (B.M. Types Rhop. Nos. 476 and 477).

*Danaus aspasia thargalia* (Fruh.). Padang, ♀.

*Danaus hamata pandora*, subsp. n. Siberut, 7 ♂♂.

Near to subspecies *septentrionalis* (Btlr.), from Sumatra, but differs on the forewing in the narrower cell-stripe and in that the irregular cellular spot near the discoidals is usually broken into two, although these two portions are united by a fine line on the underside. Ground-colour beneath darker and more uniform. Quite distinct from the Niasese subspecies *rufiventris* (Fruh.). Forewing 51 mm. (B.M. Type Rhop. No. 475.)

*Danaus agleoides odesia*, subsp. n. Siberut, ♂, 3 ♀♀ (♀); Sipora, 10 ♂♂, 21 ♀♀; North Pagi Is., 2 ♀♀.

♂. In size and markings intermediate between subspecies *mænius* (Fruh.), from Sumatra, and *erycina* (Fruh.), from Nias, but the markings in the basal half

of the forewing are rather diffuse, and the ground-colour is slightly paler in the inner areas of both wings. Forewing 37 mm.

♀. Near to Sumatran *mænius*, but differs in the whiter colour of the greyish-blue markings and in the narrower markings in the basal halves of both wings. Forewing 35 mm.

Both types from Sipora (B.M. Types Rhop. Nos. 478 and 479).

***Danaus vulgaris ocarinis***, subsp. n. Siberut, 54 ♂♂, 6 ♀♀ (8 ♂♂); Sipora, 12 ♂♂, 11 ♀♀; North Pagi Is., 5 ♂♂, 2 ♀♀.

Near to subspecies *macrina* (Fruh.), from Sumatra, but differs in the slightly whiter colour of the greyish-blue markings, and in the narrower cell-stripe on the forewing. Both sexes with broader markings than in *Niasese megaroides* (Fruh.). Forewing 36 mm. in male holotype; 35.5 mm. in female allotype. Both types from Siberut (B.M. Types Rhop. Nos. 480 and 481).

***Danaus vulgaris macrina*** (Fruh.). Padang. ♂.

***Ideopsis gaura nigrocostalis*** (Hagen). Siberut, 25 ♂♂, 27 ♀♀ (2 ♂♂, 8 ♀♀); Sipora, 5 ♂♂, 7 ♀♀; North Pagi Is., ♂, 2 ♀♀.

The male closely resembles subspecies *costalis* (Mre.), from Nias (= *batuna* Fruh., Batu Is.), but the upperside is slightly more dusky and the cell-end spots on both wings are larger and more diffuse.

***Idea stollii daldorffi***, subsp. n. Siberut, ♂, ♀; Sipora, 4 ♂♂, 6 ♀♀.

Both sexes darker and with larger black spots than in subspecies *logani* (Mre.), from Sumatra. The spots are rather larger than in form *favorinus* (Fruh.) of the Bornean subspecies *alcine* (Fruh.), and the edges are diffuse. On the upperside the wings are rather smoky, but not as dark as in form *favorinus*, and entirely lacking the coppery hue found in that form. Forewing 75 mm. in male holotype and female allotype. Both types from Sipora (B.M. Types Rhop. Nos. 482 and 483). Named after D. K. Daldorff, who visited Sumatra from 1795 to 1798

and was one of the earliest collectors to send Sumatran butterflies to Europe.

Hagen's record of *Hestia reinwardti* Mre., from the Mentawi Islands, probably refers to the form described above. A series of both sexes from Pulau Tello in the British Museum are not separable from Sumatran *Idea stolli logani* (Mre.).

*Euplœa modesta morrissi* (Hagen). Siberut, 43 ♂♂, 29 ♀♀ (♂, ♀); Sipora, 27 ♂♂, 6 ♀♀; North Pagi Is., 5 ♂♂, ♀.

A female from "Padang" so closely resembles Mentawi females, and is so different from the Sumatran subspecies *ainoæ* Bryk (= *moorei* (Btlr.), *nec* C. & R. Feld.), that it is probable that a mistake in labelling has occurred. Regarding the nomenclature of the Malaysian species of *Euplœa*, *vide* Corbet, 1942, Ann. & Mag. Nat. Hist. xi. p. 253.

*Euplœa crameri mentavica* (Hagen). Siberut, 27 ♂♂, 5 ♀♀ (♂); Sipora, 7 ♂♂, 2 ♀♀; North Pagi Is., ♀.

*Euplœa eleutho seitzi* (Hagen). Siberut, 8 ♂♂; Sipora, ♂.

*Euplœa cyndhovi arasa* Fruh. Siberut, 15 ♂♂, 17 ♀♀ (2 ♂♂); Sipora, 5 ♀♀; North Pagi Is., 2 ♂♂.

*Euplœa mulciber maassi* (Hagen). Siberut, 44 ♂♂, 11 ♀♀ (2 ♂♂); Sipora, 11 ♂♂, 9 ♀♀ (♀); North Pagi Is., ♂, 2 ♀♀.

*Euplœa mulciber vandeventeri* Forbes. Padang, ♀.

*Euplœa phænareta goodsoni*, subsp. n. Siberut, 3 ♂♂; North Pagi Is., ♀.

♂. Forewing apex more pointed than in other Malaysian races. Differs from subspecies *phæretena* Kheil, from Nias, in the much reduced spots on both wings, and particularly in the apical third of the forewing, where the marginal spots tend towards obsolescence. On the forewing the outer submarginal spots are inwardly more sharply defined than in *phæretena*, while the inner submarginal spots become fainter beyond the cell. On the underside the spots are smaller than in the Niasese race. Forewing 58 mm. (B.M. Type Rhop. No. 474.)

It is impossible to say whether the female pertains to subspecies *goodsoni* or represents a new subspecies. The upperside is darker and more uniform brown than in *phæretena* ♀, and the spots, particularly those on the forewing, are much reduced, the inner submarginal spots becoming faint beyond the cell and the marginal spots becoming obsolete at the apex. The spots are clearly defined and not diffuse as in *phæretena*. The underside is darker, with the spotting much reduced in the apical half of the forewing. Forewing 60 mm.

The new subspecies is named after Mr. F. W. Goodson, of the Tring Museum, who carried out the preliminary arrangement of the Mentawi material and to whom I am indebted for much help during visits to Tring.

*Euplœa midamus sticheli* (Hagen). Siberut, 6 ♂♂; Sipora, 3 ♂♂, 2 ♀♀.

*Euplœa midamus limyrus* Fruh. Pulau Tello, ♂.

*Euplœa leucostictos regularis*, subsp. n. Siberut, ♂, ♀.

Differs from all described races of *E. leucostictos* (Gmel.) in that the small, pale blue submarginal spots on the forewing are uniform in size and do not increase from tornus to apex. Nearest to lightly-marked examples of the Sumatran subspecies *vestigata* Btlr., but the hindwing above and both wings below are darker brown, the spotting on the underside is much reduced, and the blue colour of the upperside of the male lacks the rich lustre of Sumatran males. Forewing 48 mm. in male holotype; 44.5 mm. in female allotype. (B.M. Types Rhop. Nos. 484 and 485.)

The only species of *Danaidæ* recorded by Hagen and not obtained by Messrs. Kloss and Smedley is *Danaus melaneus* (Cram.), of which races are known from Nias and the Batu Islands.



XXIV.—*The Osteology and Relationship of the Bathypelagic Fish Macropinna microstoma, with Notes on its Visceral Anatomy.* By WILBERT MCLEOD CHAPMAN, U.S. Fish and Wild Life Service.

AUTHOR'S ABSTRACT.

The present report is a description of the osteology, gross visceral anatomy, and, to some extent, the musculature of the interesting bathypelagic fish *Macropinna microstoma* from the north-east Pacific Ocean. Of particular interest are the great changes in the head region occasioned by the enormous, dorsally-directed eyes, the peculiarities of the oral region, and the absence of an air-bladder. A new genus, *Grimaldia*, is proposed for *Opisthoproctus grimaldi* Zugmayer. A new family, Winteriidae, is proposed for the genera *Winteria* Brauer and *Rhynchohyalus* Barnard. Berg's new suborder of the Isospondyli, Opisthoproctoidei, is accepted with the provision that it be enlarged to include the Macropinnidae, Winteriidae, Xenophthalmichthyidae, Bathylagidae, Microstomidae and Argentinidae, as well as the Opisthoproctidae.

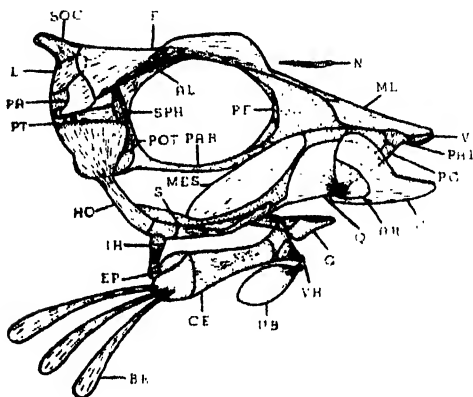
In the original description of *Macropinna microstoma* (Chapman, 1939) the writer indicated its relationships with *Opisthoproctus* on the basis of external anatomy, but found that there were sufficient differences from the latter to warrant the erection of a new family for the fish. Since that time the International Fisheries Commission has collected another specimen of this species, larger than the types, which was kindly made available for anatomical study. The following description is based on this fish, a female 52 mm. in standard length, taken at IFC Station 1750 C., Lat. 51° 46' N., Long. 131° 37' W., Feb. 1939, over 1200 fathoms of water. Appreciation is expressed to Mr. H. A. Dunlop, Director of Investigations of the International Fisheries Commission, for permission to work on this specimen.

ANTORBITAL PORTION OF CRANIUM.

The antorbital portion of the cranium is of greater extent in proportion to the postorbital portion than is

usual in fishes. It is unusual also in that the palatoquadrate complex is securely and immovably synchronized with it anteriorly. The largest element is the *ethmoid*

Fig. 1.



Lateral view of skull of *Macropinna microstoma*, with opercular and circumorbital bones removed.  $\times 24$ .

*cartilage* (figs. 1, 3 and 4). This element is broad, flattened, and U-shaped from the dorsal aspect. Posteriorly it sends a slender strip of cartilage dorsally under the frontals to the alisphenoids, and a similar strip ventrally along the dorsal side of the parasphenoid. Dorsally it is overlain by the frontals and the broadly expanded mesethmoid. Ventrally it is overlain by the parasphenoid and the vomer. Laterally it bears the prefrontals.

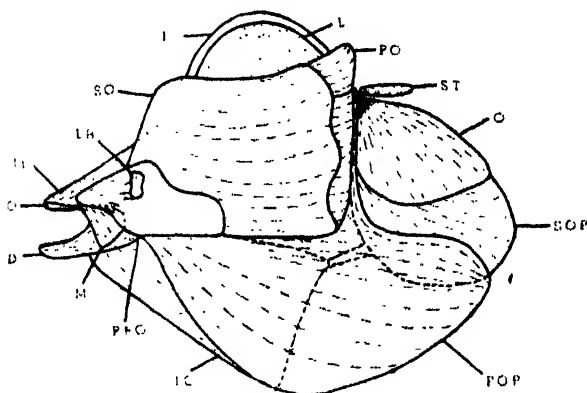
The *mesethmoid* (figs. 1, 2 and 3), while very thin, is broadened anteriorly to completely cover the anterior half of the ethmoid cartilage. Posteriorly it extends dorsally along the ridge of the latter under the frontals, which lie over its posterior end. The element appears to be ankylosed to the vomer around the anterior edge of the cranium.

The *frontals* (figs. 1 and 3) are so securely fused together on the midline that the suture is not apparent. Anteriorly they form the thin narrow structure which curves down over the ethmoid cartilage to overlie the mesethmoid.

Between the orbits they are compressed and each forms on its dorsal surface a high vane, the two of which are fused dorsally and form a closed tube for the sensory canal. Behind the orbits this vane returns to the normal level of the bone, and the bone fans out laterally over most of the dorsal surface of the postorbital region of the cranium. The antero-lateral edge of this portion of the bone is more heavily ossified than the mid-portion and forms a strong strut to lie over the dorsal side of the alisphenoid and sphenotic. Posteriorly the bone lies over portions of the sphenotic, the parietal, the epiotic, and most of the supraoccipital.

From a side view the *parasphenoid* (figs. 1 and 4) has a sigmoid shape. It is straight under the postorbital

Fig. 2.



Lateral view of skull of *Macropinna microstoma*.  $\times 24$ .

portion of the skull, where it lies in the concavity between the bulging otolith bulla. Between the orbits it curves upward to the ethmoid cartilage. From a pointed end over the basioccipital the bone widens over the large otolith bulla to the broad lateral wings. The lateral wings extend up to the prootics, but not to the alisphenoids. Anteriorly from the wings the bone becomes narrow between the orbits and continues forward nearly to the anterior end of the ethmoid cartilage. For nearly all its length on the latter the parasphenoid is overlain by the vomer

The *vomer* (fig. 4), while thin, is a broad bone of roughly triangular shape. Posteriorly it is narrow, ending in a point on the parasphenoid. Anteriorly it broadens out to form the dorsal, tooth-bearing portion of the upper jaw. It bears 40 teeth in an irregular single series. The teeth are minute and conical.

The *prefrontals* (figs. 1 and 2) are merely small points of ossification on the postero-lateral edges of the ethmoid cartilage.

#### POSTORBITAL PORTION OF THE CRANIUM.

The postorbital portion of the cranium is fore-shortened. Except for the crest of the supraoccipital there are no ridges or prominent depressions on the dorsal surface. From the posterior edge of the fused frontals the cranium slopes posteriorly and laterally. This is the dorsal area of insertion of the anterior trunk muscles. None of the lateral cranial muscles have their origins on the dorsal surface of the cranium.

All of the cartilage bones of the postorbital portion of the cranium are separated from each other by a continuous band of cartilage. The alisphenoids of the two sides are joined together by it under the frontals. Below the alisphenoids the prootics of the two sides are likewise joined together by it. Between the prootics is a slender vertical rod of cartilage in the same position and much like the basisphenoid of *Salmo*, but entirely unossified. Ventrally the cartilage is greatly expanded between the exoccipitals, prootics and basioccipitals, and bulges outward to form bulla for the large otoliths. Dorsally the cartilage is again expanded into a broad area between the epiotics, pterotics and sphenotics. The anterior portion of this space is covered by the parietal on each side. Between the epiotics and the supraoccipital the cartilage is compressed to the extent that in one point the bones are nearly suturally joined.

The most prominent feature of the ventral part of the neurocranium are the above-mentioned bulla of the otoliths (figs. 1 and 4), which form a large part of the ventral and lateral surfaces. They bulge out markedly laterally and ventrally so that the lateral surface of the cranium above them and the space between them ventrally is distinctly

concave. While the parasphenoid, prootics and exoccipitals participate in this to some extent, the main part of the bulla is made up of the expanse of cartilage noted above. Over the posterior one-third of the bulla, the exoccipitals, the basioccipital and the posterior edge of the prootics are inserted the anterior trunk muscles.

The articular head of the hyomandibular rests in the concavity above the otolith bulla and extends along the entire lateral surface of the pterotics and sphenotics. These bones and the prootics are evenly rounded, without any special projecting supports for the hyomandibular articulation.

The *supraoccipital* (figs. 1 and 3) is a large bone, most of which is covered by the frontals. Posteriorly it bears a sturdy crest. From this crest a tough, broad tendon extends posteriorly. The posterior edge of the bone slopes downward to form the roof of the foramen magnum.

The *parietals* (figs. 1 and 3) are thin superficial bones overlying portions of the pterotics, sphenotics and the broad expanse of cartilage between the pterotics. The anterior edge of each is overlain by the frontals. Mesially they extend to the epiotics and are widely separated from each other by the epiotics and supraoccipital.

The *epiotics* (figs. 1 and 3) are heavy, rather large bones forming most of the postero-dorsal edge of the skull mesially. They abut closely against the supraoccipital. Anteriorly the bones are overlain by the frontals. Posteriorly they slope downward. On the dorsal surface of the epiotics is a slight transverse groove in which the post-temporals lie.

The *alisphenoids* (fig. 1) are normal in position, size and shape. They are united dorso-anteriorly under the frontals by cartilage. A broad band of cartilage separates the bones from the sphenotics and extends, although narrower, between the alisphenoids and the prootics.

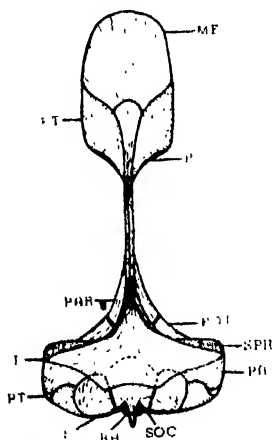
The dorsal surface of the small *sphenotics* (figs. 1, 3 and 4) is largely covered by the frontals and parietals, but is exposed anteriorly where it forms the lateral corners of this portion of the cranium.

The *pterotics* (figs. 1, 3 and 4) are small conical bones forming the postero-lateral corners of the cranium. Most of their lateral surface is covered by the hyomandibular; most of their dorsal surface is covered by the parietals.

The *basioccipital* (figs. 1 and 4) is a small but heavily ossified bone forming the ventral half of the occipital condyle. The anterior edge of the bone is overlain by the parasphenoid, where it abuts against, but does not participate in, the bulge of the otolith cases.

The *exoccipitals* (figs. 1 and 4) are large bones forming the dorsal portion of the occipital condyle, the lateral border of the foramen magnum, and the posterior third or more of the ventral and lateral surfaces of the cranium. Their most prominent feature is the large, well-ossified foramen of the vagus nerve. The bones are concave

Fig. 3.



Dorsal view of the cranium of *Macropinna microstoma*.  $\times 2\frac{1}{2}$ .

laterally, and convex ventrally where they participate slightly in the formation of the otolith bulla.

The *prootics* (figs. 1, 3 and 4) form most of the anterior surface of the brain-case as well as a large part of the antero-lateral surface. As mentioned above, the lateral surface of the bones is distinctly concave above the otolith bulla. The bones are heavily ossified around the large foramen of the trigemino-facial complex and the usual bony bridge is present, dividing the foramen into posterior and anterior openings. Mesially and antero-ventrally the bones are united by cartilage. Contrary to the usual condition, however, the bones are widely

separated postero-ventrally by the cartilage of the otolith bulla.

There are no *opisthotics*, *orbitosphenoid* or *basisphenoid*.

#### SPECIAL OSSIFICATIONS OF THE SENSORY SYSTEM.

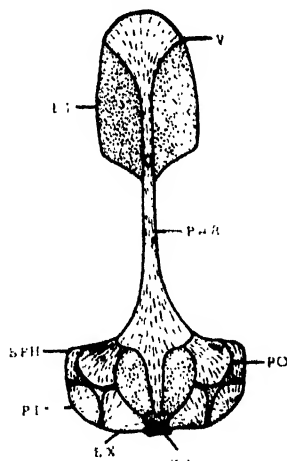
The circumorbital series is represented by three bones, the homologies of which are somewhat obscure. They are called here, however, preorbital, suborbital and postorbital. These three bones, together with a flange of the preopercle, form a complete lateral protection for the enormously expanded and dorsally directed eye, so that only the lens of the eye projects unprotected above them. All three are sufficiently translucent so that the pigmented eyeball, the muscles, and even the nerves of this region are visible through them. The *preorbital* (fig. 2) covers that lateral portion of the rostral cartilage not covered by the mesethmoid, the articulation of the lower jaw, and extends back along the anterior arm of the preopercle to a vertical from the anterior third of the lens of the eye. The enormously expanded *suborbital* (fig. 2) is the main bone of the series. Posteriorly its wavy edge conforms with the contour of the postorbital and the flange of the preopercle. Ventrally the bone is tightly bound to the anterior arm of the preopercle. Anteriorly it rests on the ethmoid cartilage ventrally and curves inward dorsally. It does not meet its mate of the other side, however, and there is consequently an unprotected space antero-mesially above the mesethmoid. Laterally the bone is convex, curving gently around the eyeball. The small *postorbital* (fig. 2) is wedged in between the suborbital, sphenotic and preopercle.

The *nasal* (fig. 1) is a slight, slender bone, concave on its dorsal side, which lies loosely in the gelatinous mass between the olfactory capsule and the frontal and serves as a protection for the anterior elongation of the sensory canal as it emerges from the frontal canal. The *lachrymal* (fig. 2) is a tiny, thin ossification lying loosely on the surface of the preorbital and partially surrounding a portion of the sensory canal. The *supra-temporal* (fig. 2) is a slight semitubular ossification of the sensory canal similar to the nasal, lying external to the levator operculi muscle above the opercle.

#### UPPER JAW.

The normal bones of the upper jaw are represented by the expanded *maxillary* only (fig. 2). Along the gape edge of the element there is observed a line which appears to separate the bone in two parts. On further dissection this line is seen to be present only in the pigmented membrane on the inner side of the bone, and when this is scraped off no division can be found in the bone itself. The maxillary is rather loosely attached to the lateral corner of the vomer. It bears no teeth and, by reason of its loose attachment, could not participate effectively

Fig. 4.



Ventral view of cranium of *Macropinna microstoma*.  $\times 2\frac{1}{2}$ .

in biting. It slides up under the preorbital between that bone and the expanded dorsal arm of the mandible.

Parr (1937) says of *Opisthoproctus soleatus* :—

“ While premaxillaries seem to be lacking even in the best preserved specimens, minute maxillaries almost in the form of a thin, somewhat sculptured scale, only, are normally present as shown in our figures 9–11; and in spite of their rudimentary condition they still retain traces of their normal form. These maxillaries, however,



are so loosely connected with the skeleton and so prominently placed on the protruding snout that they are lost by abrasion in the nets, etc., in about half of the specimens, which will explain their absence in Trewavas' example.'

The effective upper jaw is formed by the vomer, palatine and pterygoid, which are described elsewhere.

#### MANDIBLE.

The mandible is a most interesting apparatus, considerably different from that normal to fishes. The two halves are firmly joined together and the organ has the shape of a grocer's scoop. The *articular* (figs. 1 and 2) is enlarged and has roughly the shape of a quadrant with the socket of articulation at the apex. The *dentary* (figs. 1 and 2) is proportionately enlarged and notched as usual to fit around the articular. From the articulation of the lower jaw to the symphysis there is a well-ossified ridge, in the formation of which both bones participate. Along this ridge the ventral portion of the dentary bends mesially at an angle of about  $100^{\circ}$  and is expanded to meet and overlap its mate from the other. Along the midline the two bones are so securely ankylosed that they cannot be separated without tearing the elements. The floor of the mouth is thus completely protected by bone. Posteriorly the dorsal part of the dentary rises sharply along the articular and is expanded to form the sides of the scoop. On its anterior portion the dentary bears twenty-five tiny conical teeth, similar to those of the vomer above, in a single row. As will be described later, the adductor and depressor muscles of the mandible are proportionately very large and are the most prominent of the cranial muscles. Therefore the mouth, while tiny, has a rigid scoop-like mandible equipped with disproportionately strong muscles. The function of such a specialized apparatus in mid-ocean is not obvious. *Meckel's cartilage* is slender and nearly encased with bone. It is in its normal position. No *angular* or *sesamoid articular* could be found, although it cannot be stated that the former was not present.

#### PALATINE ARCH.

The palatine arch departs from the ordinary in being firmly and immovably synchondrized with the ethmoid

cartilage anteriorly, thus adding to the rigidity of the mouth-structures. The *palatine* (fig. 1) is a short and proportionately broad bone. Anteriorly it is well-ossified and bears twelve teeth similar to those on the vomer in a patch which is continuous with those on the vomer but in which the teeth are arranged irregularly in a double row.

The *pterygoid* (fig. 1) is more elongate and slender. It extends down along the quadrate nearly to the articulation of the lower jaw.

The *quadrate* (fig. 1) is large, forming nearly a semicircle. It sends a short spur posteriorly along the ventral arm of the preopercle to the symplectic. The condyle is heavily ossified as usual.

There is a single pterygoid element, here called the *mesopterygoid* (fig. 1). It is a thin, broad bone which abuts anteriorly on the rostral cartilage and the band of cartilage between it and the quadrate, and extends posteriorly to the hyomandibular. It lies flatly below the enormous eye and probably serves in some measure as a ventral support for that organ.

Parr (1937) says of *Opisthoproctus soleatus* :—

“Secondly, it was possible to see a tiny, almost circular, very weakly ossified plate in the pterygoid arch near the upper end of the symplectic, situated on the outer side of the cartilage (away from the oral cavity) which undoubtedly represents the metapterygoid. This would then make the long bony plate on the adoral side of the cartilage, questioningly designated by Trewavas as ‘(metapterygoid ?)’ the actual entopterygoid, which is also in accordance with its position.”

No such element was found in *Macropinna*, but the homology suggested by Parr has been followed, and has been confirmed on the related *Bathylagus* and *Microstoma*.

There is a continuous and broad band of cartilage between the palatine, pterygoid, quadrate, mesopterygoid and the ethmoid cartilage. Thus the osseous elements of the anterior region are securely synchondrized together so that there is no play between the palato-quadrate arch and the antorbital portion of the cranium. It is apparent that this unification of skeletal elements is associated with the rather unusual dynamics of the mouth closure. These unified structures must bear the brunt of the thrust of the operation of the lower jaw, because the ventral arm of the

preopercle, the symplectic, the hyomandibular and the posterior extension of the mesopterygoid are, by comparison, weak.

#### HYOID ARCH.

The *hyomandibular* (fig. 1) extends from the cranium downward and forward at an angle along the postero-ventral border of the eye-socket. In proportion to the rest of the bone and the short postorbital portion of the cranium the articular head is greatly enlarged. The broad articular surface is capped with cartilage and extends completely along the lateral faces of the sphenotic and the pterotic so as to traverse the postorbital part of the cranium from the eye-socket to the posterior end of the cranium. The articular head, while heavy and strong, is not so well ossified as is the ventral portion of the bone. On the posterior edge of the articular head, just before it narrows to form the rod-like ventral part of the bone, is the heavy, well-ossified opercular condyle, which projects a little ventrally as well as posteriorly. Its articular surface is also faced with cartilage. Along the lateral side of the hyomandibular from the level of the occipital condyle to the middle of the bone is a thin lateral vane of bone which serves as the surface of insertion of the levator hyomandibularis muscle.

The truncus hyoideo-mandibularis facialis nerve enters the anterior edge of the hyomandibular, soon after emerging from the cranium, on a level with the opercular condyle, and traverses the bone at a ventral and posterior angle in a large canal to emerge on the posterior edge of the bone under the above-mentioned vane.

This nerve, as it emerges from the facial foramen of the hyomandibular, continues ventrally in a groove on the outer face of the bone. It breaks up almost at once into the truncus mandibularis facialis, which runs anteriorly with many branches, and into the ramus hyoideus facialis, as well as giving off a tiny branch which goes posteriorly in two sub-branches along the operculum. The ramus hyoideus facialis continues down along the hyomandibular, posterior to the interhyal, under the bases of the branchiostegals, around the posterior end of the epihyal, and then emerges on to the ventral surface of the throat-muscles. It traverses the base of the geniohyoideus muscle and

extends along the anterior extension of that muscle and its tendon to the expanded mandible. Along its whole muscular course it is crinkled and heavy. It sends off no major branches but sends many tiny branches off along its whole course, which cover the broad branchiostegal membranes and the muscles of the throat with a network of nerves. It does not touch its mate of the other side.

Between the hyomandibular and the symplectic is a short, stout cylinder of cartilage. The *symplectic* (fig. 1) extends forward nearly horizontally to the cartilage between it and the quadrate. It has the appearance of two conical rods tapering to a middle angle. On the mesial side of the angle is a flat flange of bone forming a strengthening structure.

Both Trewavas (1933) and Parr (1937) show the cartilage between the hyomandibular and symplectic in *Opisthoproctus soleatus* to be elongate and with a definite bend, so that the upper end of the symplectic does not extend in line from the hyomandibular. As shown in fig. 1, this structure is considerably different in *Macropinna*.

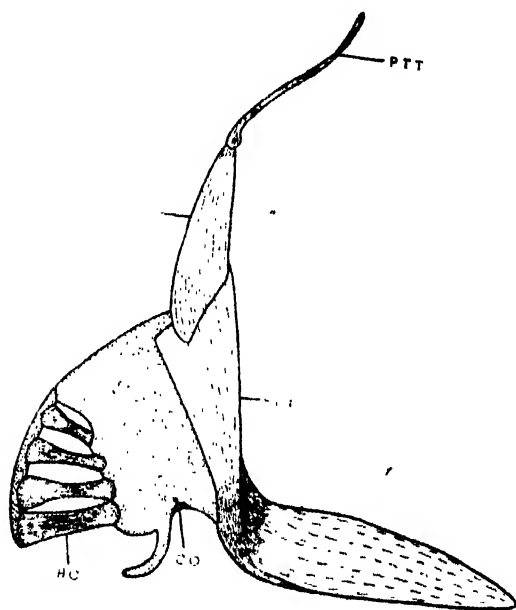
On the ventro-posterior edge of the cartilage between the hyomandibular and the symplectic is attached the *interhyal* (fig. 1). This bone is a short, stout cylinder capped on both ends with cartilage. It extends directly ventrally and is articulated with the posterior edge of the cartilage between the epihyal and the ceratohyal, at the postero-ventral edge of the epihyal. The *epihyal* (figs. 1 and 9) is a small ovoid centre of ossification on the postero-dorsal edge of the above-mentioned cartilage. The three *branchiostegal rays* (figs. 1 and 9) are inserted on this cartilage. The *ceratohyal* (figs. 1 and 9) is a heavy flat bone extending forward to the hypohyals. The *hypohyals* (fig. 1) are double and are heavy, if small, bones. The dorsal one consists of a small centre of ossification, where it abuts mesially in a groove between the first basibranchial and the glossohyal. The rest of the element is a heavy cartilage abutting against the ceratohyal posteriorly and against the ventral hypohyal ventrally. The latter element is more completely ossified but is still well separated posteriorly from the ceratohyal by cartilage. It ends ventrally in a heavily ossified knob, to which the short ligament from the urohyal is attached posteriorly

and to which the short, stout ligament from its mate of the opposite side is attached mesially.

Trewavas (1933) and Parr (1937) show the epihyal-oceratohyal-hypohyal complex extending ventro-posteriorly in *Opisthoproctus soleatus*. In *Macropinna* this apparatus (fig. 1) extends anteriorly in nearly an horizontal plane.

The *glossohyal* (fig. 1) is mainly cartilaginous and forms the major part of the tongue. Postero-dorsally, where the element abuts on the first basibranchial, it is constricted

Fig. 5.



Lateral view of shoulder-girdle of *Macropinna microstoma*.  $\times 4\frac{1}{2}$ .

and heavily ossified. On the dorsal surface of the glossohyal lies a thin pear-shaped superficial ossification with the broad end forward over the cartilaginous end of the element. The pointed posterior end lies over the ossified part of the glossohyal but does not reach to the articulation. This ossification is probably homologous to the thin tooth-bearing plate found on the tongue in other fish, but it bears no teeth here.

The *urohyal* (fig. 1) is a fairly large flat bone on which are inserted the sternohyoideous muscles. The main area of the bone is in a vertical plane. Antero-ventrally the edge flattens out. Anteriorly the bone is constricted into a small double head which is heavily ossified. From each facet goes a short, stout ligament to the ventral hypohyal of its side.

Trewavas (1933) and Parr (1937) show the *urohyal* of *Opisthoproctus soleatus* flattened in a transverse plane without a vertical mesial extension. In *Macropinna* the antero-ventral edge only is flattened, most of the bone being in a vertical plane.

#### OPERCULAR APPARATUS.

All four of the normal opercular elements are present—the opercle, the subopercle, the interopercle, and the preopercle.

The *opercle* (fig. 2) is of moderate size and ovoid. It projects downward and backward from its articulation with the hyomandibular. The point of articulation and the ledge of insertion of the levator operculi muscle are the only rigidly ossified portions of the bone.

The *subopercle* (fig. 2) is a little larger than the opercle (which overlaps its dorsal margin slightly). An antero-dorsal arm projects into the space between the opercle and the preopercle.

The *interopercle* (figs. 2 and 9) is expanded ventrally and extends mesially to overlap its mate of the other side. There is a considerable space between this bone and the subopercle. The two bones are securely joined, however, by a broad, tough ligament. This space is covered by the ventral expansion of the preopercle. The posterior portion of the interopercle is overlain by the ventral flange of the preopercle so that the bone is exposed only anteriorly.

The *preopercle* (figs. 2 and 9) has the normal boomerang shape, with an angle of about 95° to 100°. The dorsal arm is slender. It bears an anterior flange which participates slightly, with the circumorbital bones, in protecting the eye laterally. A narrow posterior flange fills the space between this bone and the opercle. The anterior arm is longer than the dorsal arm and extends to the articulation of the quadrate with the lower jaw. It bears a greatly

expanded ventral flange which projects back from the angle to slightly overlies the subopercle and cover the space between it and the interopercle. It projects ventrally to overlie its mate from the other side. Thus these bones, with the aid of the interopercles, anteriorly provide the throat with a complete armour of bone which, however, is only weakly ossified. The flange is widest below the angle of the preopercle and tapers to the anterior end of that bone, thus exposing the interopercle, the posterior portion of which it completely overlies.

#### GILL-ARCHES.

*Macropinna microstoma* has the typical four complete gill-arches, each with a double row of gill-filaments, and a fifth incomplete arch bearing no filaments. There is a pseudobranch made up of eight pinnate filaments, like those on the gill-arches, all free. The gill-rakers are short, conical, widely spaced, fleshy, with no dentations. There are 6 + 19 on the first arch. There are no teeth either on the basal line or the suprapharyngeals.

There are four *basibranchials*. The first is roughly like the glossohyal reversed, although the cartilaginous part of the element is not so large. The anterior ossified part of the bone is constricted at the articulation with the glossohyal. The bones of the basal line are all capped with cartilage at both ends. With the cartilaginous part of the first branchiostegal there is, therefore, a broad expanse of cartilage between the ossified portions of the first and second basibranchials. On the cartilage between these two elements are inserted the hypobranchials of the first arch. The second and third basibranchials are nearly the same size, of a roughly square shape from the dorsal aspect and well ossified. On the cartilage between the two are inserted the hypobranchials of the second arch. The hypobranchials of the third arch nearly meet at their insertion between the third and fourth basibranchials. The fourth basibranchial is a broad element, entirely cartilaginous, which has a considerably larger surface area than the first three basibranchials combined. Antero-laterally are inserted the ceratohyals of the fourth arch, and postero-laterally are inserted the ceratohyals of the incomplete fifth arch.

The first three arches have *hypobranchials*. Those of the fourth arch are either absent or indistinguishably included in the fourth basibranchial. All six of these elements are of nearly the same shape and size, those of the third arch being only a little shorter than those of the first arch. The shape is that of a dumbbell, like the ceratohyals, nearly straight, with the central portion constricted and strongly ossified and either end capped with a broad pad of cartilage. The ventral edges bear a V-shaped groove for the accommodation of the soft parts of the gills.

The first four arches bear *ceratobranchials*. These are similar in shape to the hypobranchials, but are slightly curved upward, leaving the mesial surface a little concave. These grow shorter posteriorly so that those of the fourth arch, although more heavily constructed, are only about two-thirds the length of those of the first arch.

The *epibranchials* of the first three arches are similar in shape and size to the ceratobranchials of the respective arches. The epibranchial of the fourth arch is absent.

The first four arches have *suprabranchials*. That of the first arch is a long, slender, slightly curved bone capped at both ends with cartilage. From the end of the epibranchial it extends posteriorly and dorsally to its ligamentous attachment on the lateral face of the cartilage of the otolith bulla. This is firmly but movably attached at both ends and forms the only ossified connection between the cranium and the visceral arches. By reason of the fact that in its normal position it rests in nearly an horizontal plane it can, by its epibranchial end swinging downward and backward, give considerable normal expansion to the size of the gullet. The suprabranchials of the second and third arches are short, vane-like bones no larger than is necessary for the attachment of the branchial muscles. They are of nearly the same size and shape. The suprabranchial of the fourth arch is greatly expanded dorsally into a thin vane, which extends well above the level of the rest of the gill-bones. It has a quadrant shape with a cartilaginous cap at the mesial apex, which is constricted and more heavily ossified than the rest of the bone. This element does not articulate with the ceratobranchial of that arch. It is connected only muscularly with that bone, the epibranchial of that arch



being absent. A similar apparatus is found in *Bathylagus*, *Microstoma* and *Argentina*.

Mesially the suprabranchials of the second, third, and fourth arch articulate one with the other by means of cartilaginous condyles. The epibranchial of the first arch articulates in a similar fashion with the suprabranchial of the second arch, so that these four elements form a semi-rigid support for the visceral arches dorsally.

On its mesial end the first epibranchial bears two cartilage-capped condyles. To one of these is attached the suprabranchial of that arch. The other joins the middle of the anterior edge of the suprabranchial of the second arch.

#### PECTORAL GIRDLE.

The *post-temporal* (fig. 5) is a slender but long ray of bone which is curved on its mesial side to lie dorsally over the ends of the dorsal body-muscle bands. It extends along the dorsal surface of the epiotic (which is slightly grooved for its reception) and the supraoccipital to nearly meet its mate of the opposite side. Proximally it is slightly expanded to lie over the end of the supra-cleithrum.

The *supracleithrum* (fig. 5) is a simple, broadened, thin bone. It is no longer than the post-temporal. Its ventral half lies externally over the dorsal arm of the cleithrum. Its ventral end extends below the dorsal edge of the insertion of the primary shoulder-girdle on the cleithrum.

The *cleithrum* (fig. 5) is the major bone of the secondary shoulder-girdle. The dorsal arm is shorter than the ventral arm and forms with it an anteriorly facing angle of about 100°. The primary shoulder-girdle is inserted along the mesial side of the dorsal arm and does not extend onto the ventral arm. The ventral arm is expanded laterally and thin. On the anterior half of the dorsal face of this expansion originate the posterior end of the strong sternohyoideus muscle, and the two pharyngoclavicularis muscles. On the ventral surface of the anterior arm of the cleithrum are inserted the antero-ventral body muscles. The anterior ends of the two bones are joined ligamentously. They do not extend ventrally below the level of the body muscles and do not project into the ventral outline of the body.

There are four *actinosts* (fig. 5) of normal hour-glass shape, progressively longer ventrally. The ventral one is twice the length of the dorsal one. The dorsal-most ray of the pectoral fin articulates over the scapular cartilage. There is no distinct separation of scapula and coracoid. On the ventral edge of the structure is a little point of ossification. All the rest is cartilage. Staining with alizarin shows a dorsal and ventral pinkish area with a lighter band between, but the differentiation is so faint that it cannot be shown with certainty. Above the one ventral point of ossification is a tiny foramen no larger than a pin-prick. The ventral edge of the primary shoulder-girdle is curved mesially. From its mid-edge extends a prong of cartilage ventrally and a little mesially and posteriorly, which lies over the ventral body musculature but is not attached to it. This is probably homologous with the posterior process of the coracoid found in some other fish. There is no anterior process extending to the anterior end of the cleithrum. With the exception of the mesial curvature of its ventral edge the primary shoulder-girdle is in a vertical plane.

There is no *mesocoracoid* and there are no *postcleithra*.

#### AXIAL SKELETON.

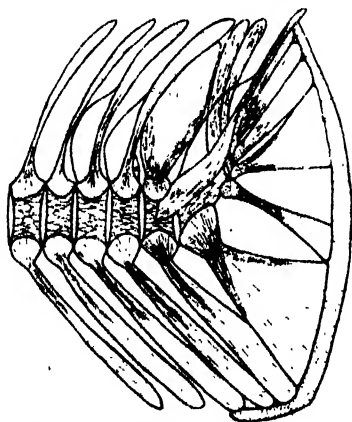
There are 35 vertebral centra, not counting the terminal urostyle, of which 17 are precaudal and 18 typically caudal. With minor exceptions the vertebral column is as shown by Trewavas (1933) for *Opisthoproctus*. There are epineurals on at least the first 24 vertebræ. Posteriorly they are so thin and thread-like that it could not be determined with certainty if they were present on the last 11 vertebræ. There are no epipleurals. The first interneural is more expanded than shown for *Opisthoproctus* and forms a partial protection over the foramen magnum.

There are 12 basalia for the anal fin. The first is tiny and bears no ray. The second is much longer. The third is the longest and reaches nearly to the hypural spine of the nineteenth vertebra. The remaining basalia grow shorter posteriorly. There are 13 anal rays of which the last is deeply bifid. The middle rays are the longest and when depressed reach a little beyond the end of the body. In outline the fin is evenly rounded.

The dorsal fin is supported by twelve basalia, each of which bears one ray. The first basalia is not expanded anteriorly as in *Opisthoproctus*. The middle rays are the longest and when depressed reach beyond the adipose to the first caudal rays. The first basalia is inserted between the neural spines of the thirteenth and fourteenth vertebræ.

The pelvic fin has eleven rays, all of which are stout proximally and extend to tenuous tips. The tips of the longest reach to the base of the middle caudal rays. The pelvic bones are nearly in an horizontal plane. Posteriorly each element is cartilaginous where the fin-rays are

Fig. 6.

Caudal skeleton of *Macropinna microstoma*.  $\times 7$ .

inserted. From the external half of the edge an ossified thin portion extends anteriorly. The anterior end is capped with cartilage. The bone is inserted under the ventral edge of the seventh, eighth, and ninth myomeres (counting back from the anterior end of the cleithrum). The pelvic muscles are certainly not strong enough to employ such a large fin in vigorous swimming motions. It is probable that the fin when expanded would serve as an hydrostatic organ (increased surface area) rather than an organ of motion.

The last six vertebræ and their dorsal and ventral processes, with the terminal urostyle, form the osseous support of the typically homocercal tail (fig. 6). The

slender cartilaginous urostyle extends out beyond the outline of the hypurals. On the cartilage of its posterior edge it bears four hypurals which grow progressively larger and longer ventrally. Covering the dorsal side of the urostyle, the last vertebra, and extending part way over the penultimate vertebra is a sheath-like ossification. On its dorsal surface is a thin but rather broad vane. Passing through this vane and extending dorsally beyond it are the two closely approximating dorsal caudal-radials. The last vertebra only is turned dorsally and is tapered postero-dorsally. On its lower surface it bears two hypurals. The dorsal one extends ventro-posteriorly from the edge of the vertebra. It is separated by broad spaces from adjoining hypurals. The ventral hypural is the largest of all those supporting the tail. The next five vertebrae anteriorly have the normal hour-glass shape and each bears one dorsal and one ventral process. The ventral processes depart from the normal only in having broadened ventral ends. The neural spine of the penultimate vertebra is greatly broadened and wedge-like.

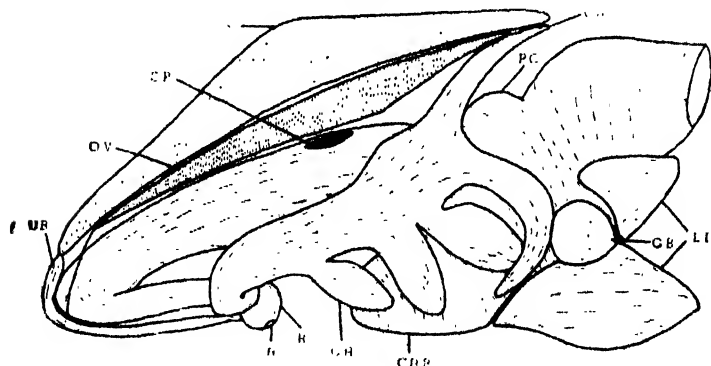
The body is covered with thin cycloid scales which are caducous except along the lateral line, where they are somewhat swollen and adherent. On the scales are about ten circuli, the first of which (anteriorly) is nearly straight. The middle one is closed. The others all terminate at the edge of the scale. There is no sign of annular formation. A scale from the lateral line is similar but has a large pore mesially about halfway between the centre of the scales and the anterior edge. The inner circuli of these scales do not close.

#### VISCERAL ANATOMY.

The stomach (fig. 7) comes directly from the broad gullet without the intervention of a narrowed oesophagus. It is large, globular and thick-walled, filling a third or more of the body-cavity. The narrowed pyloric end takes off the left side of the enlarged cardiac end, well forward. Behind the pylorus are two long narrow cæca; one curving mesially and dorsally, the other antero-ventrally along the right side of the stomach. Behind these on the right ventral side of the intestine are three additional shorter, plumper cæca. The small intestine extends diagonally from the pylorus to a short distance

behind the anus, where it turns sinistrally and goes dorsally and anteriorly nearly to the level of the pylorus again. At this point there is a constriction and the spiral valve begins. The spiral valve is quite similar, if less extensive, than the same structure in *Bathylagus*, *Leuroglossus*, *Microstoma*, and as illustrated for *Argentina* by Kendall and Crawford (1922). This organ runs posteriorly and ventrally to the end of the body-cavity near the base of the anal fin. While the intestine was so tender that perfect dissection was not possible, at least five or six well-developed valves could be seen. These consisted of laminated, flat projections from the intestine wall which were a little less than half the diameter of the intestine, so that there was an opening through the centre of the intestine. The intestinal walls were quite thin

Fig. 7.



View of right side of abdominal organs of  
*Macropinna microstoma*.  $\times 4\frac{1}{2}$ .

in between the valves, so that indications of the latter are visible externally. In its posterior half that portion of the intestine becomes gradually smaller and the valves gradually become smaller and merge into the irregular laminations of the interior of the intestine. The intestine then turns ventrally and runs forward to the level of the pelvic fins. Here it expands into a spherical rectum. A hemispherical portion of the rectum extends beyond the ventral body-wall. The anus opens on the antero-ventral surface of this projection. No rectal glands are evident.

The spleen is a small, flat, oblong organ lying on the right dorsal surface of the large intestine. It is vertical from the posterior end of the stomach. The ovaries are paired and elongate, extending under the kidney and lying over the large intestine and the antero-dorsal cæcum. They are filled with tiny eggs of equal size placed in transverse bands. From the posterior end of each ovary a fine duct extends in the mesentery over the side of the ventral flexure of the large intestine. Whether the ducts enter the urinary bladder or extend along its surface to the rectum could not be determined. The kidney is proportionately large and thick. As usual it lies outside the peritoneum and along the dorsal edge of the body-cavity. Posteriorly it ends in an urinary bladder without the intervention of a noticeable duct. The bladder is broad and has tough walls. It runs around the posterior end of the large intestine and extends ventrally to the posterior wall of the rectum.

The median lobe of the liver is the longest, lying between the ventral arms of the cleithra and around the antero-ventral portion of the cardiac arm of the stomach. The right lobe is smaller than the left. Both curve around the anterior portion of the stomach. The gall-bladder is spherical and lies along the right antero-lateral surface of the stomach. It is thin-walled and translucent. Bile fluid, if present, was without colour. No trace of an air-bladder could be found.

#### MYOLOGY.

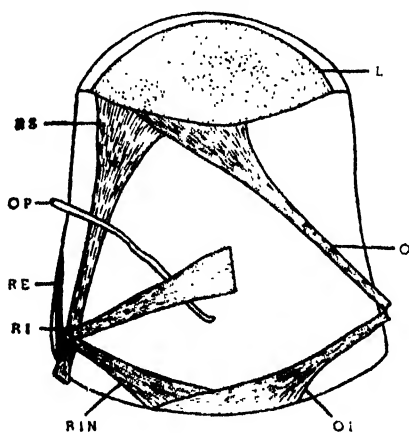
##### *Muscles of the Eyeball* (fig. 8).

The changing of the eye from a lateral to a vertical position has brought about changes in the position of insertion of the eye-muscles. All of the eye-muscles are quite thin and apparently degenerate, the rectus externus being particularly slender. The rectus inferior and the obliquus inferior, while very thin, are much broadened at their insertion. They are inserted directly on the bottom of the eyeball. The obliquus lies over the top of the rectus and both have their end well toward the lateral edge of the bottom of the eyeball, so that by their action there could be a slight rotation outward of the lens. The rectus superior and the obliquus superior overlap

slightly at their insertion. They are inserted dorso-mesially at a level with the dorsal edge of the pigmented capsule. The rectus goes nearly vertically from its origin to its insertion. The rectus internus is the shortest of the eye-muscles and has its insertion a little below the centre of the mesial surface of the eyeball just anterior to the entrance of the optic nerve. The rectus externus, unlike the other eye-muscles, does not widen at its insertion but remains very slender. It is inserted on the postero-lateral edge of the eyeball below the edge of the pigmented capsule.

The optic nerves emerge together from the cranium, being tightly bound together at their crossing, and

Fig. 8.



Mesial view of eye of *Macropinna microstoma*.  $\times 4\frac{1}{2}$ .

separating as they enter the orbit. They pass mesially to the rectus superior, but are overlain by the rectus internus and by it pressed tightly against the eyeball. They enter the eyeball ventral and a little posterior to the insertion of the rectus internus.

The oblique muscles have their origin forward in the normal position on the ethmoid cartilage. The rectus inferior and rectus internus originate on the prootic and the cartilage between the prootics. The rectus superior appears to have its origin on the parasphenoid near the

prootics. It passes laterally to the origins of the rectus internus and rectus inferior. The eyeballs are closely pressed together and there is only a slight membrane between them. In this specimen the eyeball is 9 mm. high, 10 mm. wide at the base, and the lens of the eye is 5 mm. in diameter.

As in *Bathylagus*, there is no true myodome, the posterior attachment of the eye-muscles being in a shallow concavity between the parasphenoid, prootics, and the cartilage which joins the latter bones together anteriorly.

The application of "telescopic" as an adjective to describe this type of eye is a misnomer. The rectus externus and rectus internus might give a slight rotary movement (for which there would appear to be little necessity). The rectus superior and obliquus superior could give an inward tilt, and the rectus inferior and obliquus inferior an outward tilt, but there is no mechanism whatever for retraction. Furthermore, the cylindrical eyeball is not firm and tight like an ordinary eyeball, but is thin-walled and flexible (at least in the well-preserved specimen at hand).

*Muscles Innervated by the Trigeminal and Facial Nerves.*

The adductor mandibularis is a long, large muscle. It originates in the angle of the preopercle, on the lower half of the hyomandibular, on the posterior part of the mesopterygoid, and on the cartilage between the latter two bones. Anteriorly it narrows to a broad tendon, which is inserted on the dorsal arm of the mandible.

The levator hyomandibularis muscle originates on the antero-lateral corner of the postorbital portion of the cranium on the anterior face and corner of the sphenotic. The area of origin is small and partly on the cartilage between the sphenotic and prootic. The muscle radiates to its insertion on the antero-lateral face of the hyomandibular. Ventrally some of its fibres extend over the facial foramen of the hyomandibular.

The dilator opercularis muscle originates on the lateral face of the sphenotic and the cartilage between it and the prootic. The anterior part of its origin is overlain by the levator hyomandibularis. It runs ventrally and posteriorly to its insertion on the external edge of the socket of articulation of the opercle.



The levator opercularus muscle originates on the lateral face and posterior corner of the pterotic. It does not send fibres to the dorsal surface of the cranium. It radiates to its insertion on the mesial ledge, extending back from the facet of the operculum. Its action is to raise as well as draw in the opercle.

The adductor hyomandibularis and the adductor arcus palatinus muscles are a continuous thin sheet of muscle with no indication of a separation. A few posterior-most fibres originate on the prootic. The rest of the broad origin of the muscles is on the lateral wings and orbital portion of the parasphenoid. It extends forward to a vertical from the anterior end of the vertical flange of the frontals. The equally broad insertion begins on the anterior edge of the articular head of the hyomandibular, extends down along that bone, the cartilage between it and the mesopterygoid, and along the posterior half of the mesial edge of the latter.

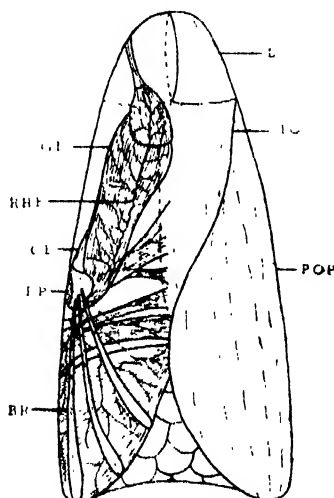
The muscles of the throat, with the adductor mandibularis, are the prominent and heavy muscles of the cranial region. There is no sign of an intermandibularis muscle. Since the ventral edges of the dentaries overlap and are securely ankylosed, there would appear to be no function for such a muscle, although it is present in *Opisthoproctus* (Trewavas, 1933).

The geniohyoideus muscle (fig. 9) originates entirely on the broad wedge of cartilage between the ceratohyal and the epihyal. It lies forward against the full length of the ceratohyal and ventral hypohyal but is not attached to those bones. Under the hypohyal it becomes united with its mate from the opposite side. From this point forward the muscles then diverge and shortly constrict to a tendon which is narrow but strong, and is about the same length as the anterior portion of the muscle. It is inserted on the mesial side of the lateral groove of the mandible about halfway between the articulation and the symphysis. The muscle appears to use the anterior end of the ceratohyal and the hypohyal for a fulcrum. It is divided transversely into three distinct parts: the first extending from the origin to midway along the ceratohyal; the second going on to the hypohyals; and the third originating superficially on the second and extending laterally to the tendon of insertion.

The mouth, while small, is thus provided (with the adductor mandibularis) with a proportionately powerful apparatus for opening and closing. Since the dentition is weak the use of so much power is not at once apparent.

The interhyoideus muscle (fig. 9) also originates on the wedge of cartilage between the epihyal and the ceratohyal, but on the mesial side of the ventral edge so that it is internal to the origin of the glossohyoideus which lies superficially over its origin. The muscle is considerably

Fig. 9.



Gular region of *Macropinna microstoma*,  
with bones of right side removed.  $\times 2\frac{1}{2}$ .

heavier than those which follow posteriorly, but is not thick like the glossohyoideus. It meets its fellow of the opposite side at the midline of the throat and is not inserted on any bone. The end of insertion is double. Behind this there are two distinct bands of muscles and then a broad area of diffused muscular tissue. These muscles, thin and long, extend from the midline of the throat over the branchiostegal rays and membranes. Their only ossified supports are the branchiostegal rays.

*Other Muscles of the Cranial Region.*

Unfortunately the muscles associated with the gill-arches were in part destroyed during the dissection of the bones of the region, and since only one specimen was available for this study the following brief notes are all that are possible :—

The levatores arcuum branchialium originate in a common area on the cartilage between the prootics and the lower edge of those bones. From this area they radiate out separately to their insertions. The transversus dorsalis anterior forms a prominent muscle mass between the epibranchials of the second arch. The adductor arcuum branchialium of the fourth arch is a prominent muscle lying in the angle between the supra-branchial and the ceratobranchial. Dorsally it is broad, covering the whole posterior surface of the broadly expanded suprabranchial. The pharyngo-clavicularis internus originates on the mesial edge of the cleithrum about halfway along the ventral arm of that bone and mesial to the sternohyoideus muscle. It extends dorso-ventrally to the fifth ceratobranchial. The pharyngo-clavicularis externus and the pharyngo-hyoideus were not followed. The sternohyoideus is a large muscle. It originates on the broad dorsal surface of the anterior arm of the cleithrum and extends forward to its insertion on the urohyal. The muscles of the opposite side are partially separated at their insertion by the vertical wing of the urohyal.

*Ventral Body Musculature.*

The anterior body musculature meets ventrally under the cleithra, but posteriorly the muscles of the opposite side are widely separated over the belly, leaving a wide expanse of black peritoneum visible through the skin. Near the ventral midline on both sides is a slender muscle which extends from the anterior tip of the cleithrum to the base of the anal fin. These are close together except where they bend around the anus, and widely separated from the muscles of the myotomes except at their ends. There is no evidence of segmentation.

There are two pelvic muscles: a flat ventral muscle originating on the ventral surface of the anterior process

of the pelvic bone and inserted on the ventral prongs of the fin-rays, and a dorsal muscle of the same shape and size originating on the dorsal surface of the anterior process and inserted on the dorsal prongs of the fin-rays.

#### RELATIONSHIPS.

While the ichthyological fauna of the ocean depths is very imperfectly known as yet, several species of fish have been described which are more-or-less closely related to *Macropinna*. The relationships of these fishes has been, and still is, obscured by the lack of knowledge of their internal anatomy; a lack brought about by a reasonable reluctance to dissect unique or rare specimens.

Two species of *Opisthoproctus* have been described, *O. soleatus* Vaillant and *O. grimaldi* Zugmayer. *O. soleatus* has been taken in the eastern Atlantic from the Gulf of Guinea to the latitude of northern France and to the Azores (Roule and Angel, 1933); in the western Atlantic in the vicinity of the Bahamas (Parr, 1937); and in the South China Sea (Trewavas, 1933). *O. grimaldi* is known from the eastern Atlantic from the Bay of Cadiz to the Azores and Canaries (Roule and Angel, 1933), and in the western Atlantic from the vicinity of the Bahamas (Parr, 1937). The two species are widely different in several particulars of external anatomy, sufficiently so, in the writer's mind, to justify the erection of a separate genus, *Grimaldia*, for the latter species. The generic characters appear in the following synopsis, taken mainly from Roule and Angel (1933):—

1. Diameter of eye less than the length of the snout; ventral sole not extending anterior to a vertical from the nasal capsule; anal fin well formed in young or small in adult, but always plainly visible externally; origin of pelvic fin posterior to that of the dorsal fin; minute teeth on vomer and dentary.... *Grimaldia*, new genus.  
(Type and only known species, *Grimaldia grimaldi* Zugmayer.)
2. Diameter of eye equal to, or greater than, the length of the snout; ventral sole generally extending anterior to a vertical from the nasal capsule; anal fin very small and closely pressed against the caudal in the young, absent or at least not visible externally in the adult; origin of pelvic fin on a vertical from the origin of the dorsal; no teeth on vomer or dentary ..... *Opisthoproctus* Vaillant.

Zugmayer (1911) says :—

“ Les dents rudimentaires se trouvent en une série sur le bord antérieur de la mâchoire inférieure et sur l'intermaxillaire il y a une série de dents microscopiques ne formant à proprement parler qu'une surface rude.”

Fowler (1936) follows him in saying that the premaxillary has microscopic teeth. Since Zugmayer made no dissection and *Opisthoproctus* and *Macropinna* have no premaxillaries (after the careful studies of *Opisthoproctus* by Trewavas (1933) and Parr (1937), the figure given by Gregory (1933) showing a premaxillary should be viewed with suspicion), the writer understands him to mean that the vomer bore minute teeth, especially in view of the fact that it is characteristic of *Argentina*, *Bathylagus*, *Microstoma*, and *Macropinna* that the dentition of the upper jaw is confined to a single row of small teeth around the anterior end of the vomer, which in some genera extends onto the palatines also.

Of these two genera of the family Opisthoproctidæ, *Macropinna* resembles *Grimaldia* most, but because of the absence of anatomical knowledge of that genus it is necessary to make the comparison with *Opisthoproctus*. It is unusual that two fish which share such prominent peculiarities should differ as much as they do. Some of these differences are as follows, the character given first for *Macropinna*, then followed by the condition in *Opisthoproctus* given in parentheses :—

Anal fin normal in size and position (anal fin absent or small and closely pressed against the caudal fin), anus forward between the pelvic fins (anus posterior near the lower rays of the caudal fin), air-bladder absent (air-bladder much enlarged, extending ventrally from cleithra to the anus), kidney unpaired (kidneys definitely paired anteriorly), gall-bladder spherical and restricted to the anterior wall of the stomach (gall-bladder elongate, as long as the stomach, and extending dorsally over the stomach), five pyloric cæca (three pyloric cæca), intestine recurved on itself (intestine extending straight to the anus), cleithra not projected into ventral outline and no ventral “sole” present (cleithra projecting from the ventral outline and forming the anterior support of the characteristic ventral “sole”), three slender branchiostegal rays of roughly the same size (two branchiostegal

rays, one much shorter than the other), opercle longer than deep (opercle much deeper than long), subopercle as large as the opercle (subopercle small and nearly hidden by the opercle), no ossified scapula present (ossified scapula present and coracoid much better ossified than in *Macropinna*), and the greatly expanded interopercle and ventral arm of the propercle which overlap ventrally over the throat (Trewavas does not mention explicitly enough for comparison the gular extensions of the interopercle and preopercle). The characters for *Opisthoproctus* in this study, unless otherwise mentioned, are taken from the excellent study of the anatomy of *O. soleatus* by Trewavas (1933).

These differences appear sufficient to justify the retention of *Macropinna* in a separate family Macropinnidæ.

Two other genera of fishes, *Winteria* Brauer and *Rhynchohyalus* Barnard (originally described as *Hyalorhynchus* by Gilchrist and von Bonde, 1924, but changed by Barnard, 1925, because *Hyalorhynchus* was preoccupied by Ogilby, 1910), obviously are closely related to the Opisthoproctidæ and Macropinnidæ. Unfortunately, nothing is known of their internal anatomy, other than radiographs taken of *Winteria* by Roule (1937), and the descriptions of both are so brief as to make it impossible to state their precise relationship. They share a more elongate shape (depth 3.1 to 3.8 in length), more or less dorsally directed enlarged eyes with concomitant narrow interocular space (which probably means fused frontals as in the Opisthoproctidæ and Macropinnidæ), normally developed anal fin well in advance of the caudal, absence of ventral "sole," pelvics in middle of body in advance of the origin of the dorsal, etc. Barnard (1925) has placed these two genera provisionally in the Microstomidæ, to which they bear at most a remote relationship. Roule (1937) has placed *Winteria* in the Opisthoproctidæ, from which the above characters serve at once to separate it. (My opinion is concurred with by Berg, 1940.) It is suggested that until such a time as more information becomes available concerning these two highly interesting fish they should be placed in a separate family, Winteriidæ, which should stand somewhere between the Bathylagidæ and Microstomidæ on the one hand, and the Opisthoproctidæ and Macropinnidæ on the other.

Trewavas (1933), following Brauer (1906), considered the Opisthoproctidæ to be "Salmonoids." Jordan (1923) places them in the Stomatoidei, but Regan and Trewavas (1930) do not include them in their listing of "Stomatoid" fishes. Insofar as the anatomy of the fishes of these groups are known, the Salmonidæ (Parker, 1873, and Tchernavin, 1939), Coregonidæ (Boulenger, 1895, and dissections by the writer), Thymallidæ (dissections by the writer), Osmeridæ (Chapman, 1941), or Galaxiidæ (Swinerton, 1903) bear only slight relationship to the fishes being considered. The anatomical discussions of the Astronesthidæ, Chauiodontidæ, Stomiatidæ, and Malacosteidæ by Regan and Trewavas (1929 and 1930) reveal only general resemblances (the reduced number of pyloric cæca and the shape of the stomach should be noted).

Berg (1937 and 1940) erected for the Opisthoproctidæ a separate suborder in the Isopondyli (Clupeiformes), the Opisthoproctoidei. To this opinion the writer subscribes, adding thereto the Macropinnidæ, Winteriidæ, Xenophthalmichthyidæ, Bathylagidæ, Microstomidæ, and Argentinidæ. Further research may show that other deep-sea fishes, such as the Dolichopterygidæ, bear affinity to this group. An extensive definition of the suborder and its components must await completion of anatomical work on some of the above families, and a discussion of the relationship of the suborder to the remaining Isospondyli must await considerably more information concerning the anatomy of that heterogeneous group of fishes.

*Abbreviations Used in All Figures.*

A. Anus.	EX. Exoccipital.
AC. Actinosts.	F. Frontal.
AL. Alisphenoid.	G. Glossohyal.
AR. Articular.	GB. Gall-bladder.
BA. Basisoccipital.	GE. Geniohyoides.
BR. Branchiostegal ray.	HO. Hyomandibular.
CA. Cæcum.	IH. Interhyal.
CAR. Cardiac arm of stomach.	IO. Interopercle.
CE. Ceratohyal.	K. Kidney.
CL. Cleithrum.	L. Lens of eye.
CO. Coracoid.	LA. Lacrymal.
D. Dentary.	LI. Liver.
E. Epiotic.	M. Maxillary.
EP. Epiphyal.	ME. Mesethmoid.
ET. Ethmoid cartilage.	MES. Mesopterygoid.

N. Nasal.  
O. Opercle.  
OI. Obliquus inferior.  
OP. Optic nerve.  
OS. Obliquus superior.  
OV. Ovary.  
PA. Parietal.  
PAL. Palatine.  
PAR. Parasphenoid.  
PF. Prefrontal.  
PG. Pterygoid.  
PO. Postorbital.  
POP. Preopercle.  
POT. Prootic.  
PRO. Preorbital.  
PT. Pterotic.  
PTT. Post-temporal.  
PY. Pyloric end of stomach.  
Q. Quadrate.

R. Rectum.  
RE. Rectus externus.  
RHF. Ramus hyoideus facialis.  
RI. Rectus inferior.  
RIN. Rectus internus.  
RS. Rectus superior.  
SC. Supracleithrum.  
SO. Suborbital.  
SOC. Supraoccipital.  
SOP. Subopercle.  
SP. Spleen.  
SPH. Sphenotic.  
ST. Supratemporal.  
S. Symplectic.  
UB. Urinary bladder.  
UR. Urohyal.  
V. Vomer.  
VH. Ventral hypohyal.

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XXV.—*The Fossil Acrididæ (Orth. Salt.)*.—Part III.  
Acridinæ †. By FREDERICK E. ZEUNER, British Museum  
(Natural History).

Family Acrididæ.

Subfamily ACRIDINÆ (*TRUXALINÆ*).

A fair number of fossil Acrididæ have been placed in this subfamily by their describers on insufficient grounds, partly because of superficial resemblance to certain Recent Acridinæ, and partly because the authors had the "feeling" that the insects belonged to this subfamily. In the present revision all these forms have been relegated to the Acrididæ *incertæ sedis*, which will be listed and discussed in Part IV. of this paper.

Unfortunately, all the Tertiary forms hitherto considered as Acridinæ have had to be eliminated in this manner. There remain only the seven species from the Pleistocene

† Part I. Catantopinae, Ann. & Mag. Nat. Hist. (11) viii. pp. 510-522 (1941). Part II. CEdipodinae, *ibid.* ix. pp. 128-134 (1942).

deposits of Starunia, near Stanislawow, in the Polish Carpathians. They are of especial interest both because of their close relationship to Recent forms and because they characterize well the climatic conditions of one of the cold phases of the Pleistocene.

In the following synopsis, specimens which do not exhibit characters distinguishing them from other well-defined forms, and therefore may, or may not, be conspecific with them, have been assigned to the species to which they possibly belong. In this way, seven species can be distinguished clearly, though the possibility remains that some of the poorly-preserved specimens assigned to one or the other may represent some unrecognized form.

The subfamily Acridinæ will have to be divided when a thorough revision of all the Recent genera is carried out. The fossil forms belong to the group around *Chorthippus* Fieb., which is characterized by stridulatory modifications of the elytral venation, especially in the male, one or several of the areas between the costa and the cubitus being widened. This group may be called Gomphocerini in accordance with Jakobson's suggestion (Jakobson & Bianki, 1905, p. 219), and treated as a tribe for the time being.

#### Genus *PODISMOPSIS* Zubowsky.

1846. *Monopterus*, Fischer-Waldheim, Nouv. Mém. Soc. imp. Nat. Moscou, viii. p. 252. (Genotype, *M. gracilis* F.-W. Preoccupied by *Monopterus* Lacépède, 1800; Pisces.)  
 1900. *Podismopsis* Zubowsky, Hor. Soc. ent. Ross. xxxiv. p. 2.  
 1910. *Podismopsis* Zub., Kirby, Syn. Cat. Orth. iii. p. 147.  
 1928. *Podismopsis* Zub., Rehn, Proc. Acad. nat. Sci. Philadelphia, lxxx. p. 195.  
 1932. *Podismopsis* Zub., Bey-Bienko, Eos, viii. p. 58.  
 1934. *Podismopsis* Zub., Zeuner, Starunia, iii. p. 4.  
 1940. *Podismopsis* Zubovaky, Uvarov, Ann. & Mag. Nat. Hist. (11) vi. p. 113. (*Podismopsis* Zub., syn. *Monopterus* F.-W., the former valid since the latter preoccupied.)

*Genotype*.—*Podismopsis altaica* Zubowsky, 1900 = *Monopterus gracilis* Fischer-Waldheim, 1846.

*Distribution*.—Recent: Northern Asia from Korea, Yezo and the Altai into the polar zone, polar Russia, and mountains of Montenegro. Pleistocene: Polish Carpathians.

*Remarks*.—Bey-Bienko divided this genus into three subgenera, *Eurasiobia* B.-B., *Podismacris* B.-B., and *Podismopsis* Zub. The fossil form described below is intermediate between *P. gracilis* (F.-W.) and *P. relictæ*

Rme., which have been placed by Bey-Bienko in *Podismopsis*, s. str., and *Eurasiobia*, respectively. As I have explained more fully in 1934, the fossil is a geographical form intermediate between *P. gracilis* and *P. relictæ*, and the subgenera *Podismopsis*, s. str., and *Eurasiobia*, at any rate, have to be combined into one. Most probably the distinction of subgenera in *Podismopsis* cannot be upheld.

\**Podismopsis gracilis pleistocenica*, subsp. n.

\*1934. *Podismopsis altaica* Miram, Zeuner, Starunia, iii. pp. 2, 3, fig. 2 a.

\*1934. *Podismopsis* cf. *relictæ* Ramme, Zeuner, Starunia, iii. p. 4, fig. 2 b.

1934. *Podismopsis relictæ* und *altaica*, Zeuner, N. Jb. Min. etc., Beil.-Bd. lxxii. (B), p. 370.

*Diagnosis*.—A subspecies of *P. gracilis* (F.-W.) intermediate between *P. g. gracilis* (F.-W.) and *P. g. relictæ* Rme. Male elytra more slender than in *P. g. gracilis*, but less slender than in *P. g. relictæ*. Subgenital plate of male shorter than in *P. g. relictæ*, and sometimes as short as in *P. g. altaica*.

*Distribution*.—Upper Pleistocene: Starunia, near Stanislawow, Polish Carpathians.

*Holotype*.—Polish Academy of Sciences, Cracow. Starunia collection, tube and preparation no. 4, labelled *P. cf. relictæ*.

*Paratypes*.—Same collection, tubes and preparations nos. 3, 7, 11, 19.

*Parts known*.—Complete males.

*Remarks*.—As I was able to show in 1934, these specimens form a gliding transition from *P. g. gracilis* to *P. g. relictæ* Rme. It is impossible, therefore, to maintain these two forms as independent species; they are members of a *Rassenkreis* or *subspecies-group* composed of *P. gracilis gracilis* from the Altai, *P. gracilis pleistocenica*, subsp. n., from Poland, and *P. gracilis relictæ* from Montenegro. The subspecies intermediate, both morphologically and geographically, between *P. g. gracilis* and *P. g. relictæ*, has become extinct in comparatively recent times, and the two surviving races are now on the way to become species. This case provides an excellent example for the formation of species from a continuous subspecies-group, as a consequence of the extinction of intermediate forms.

## Genus STENOBOTHRUS Fischer.

1853. *Stenobothrus* Fischer, Orth. Europ. p. 313.1910. *Stenobothrus* Fisch., Kirby, Syn. Cat. Orth. iii. p. 160.  
(Designates genotype : *Gryllus Locusta lineatus* Panzer.)*Genotype*.—*Gryllus Locusta lineatus* Panzer, 1796.*Distribution*.—Recent : Europe, north-west African mountains and temperate Asia. Pleistocene : Polish Carpathians.\* *Stenobothrus posthumoides* Zeuner.H 1934. *Stenobothrus posthumoides* Zeuner, Starunia, iii. pp. 5, 6,  
figs. 3 a, b.

\* 1934. Kopf, Zeuner, Starunia, iii. p. 12 (?).

1934. *Stenobothrus posthumoides*, Zeuner, N. Jb. Min., etc., Beil.-Bd.  
lxxii. (B), p. 370.*Diagnosis*.—Male with elytra 12.2–12.7 mm. long, pronotum 3.2 mm. long. *Sc* thickened in its middle portion, slightly S-shaped. Between *Sc* and *R* cross-veins in the basal portion only, distally as far as the subapical spot hyaline, and without cross-veins. In these and other characters resembling *S. posthumus* Rme., but discoidal cell longer and narrower than in this species.*Holotype*.—Polish Academy of Sciences, Cracow. Starunia Collection, tube and preparation no. 10. (Zeuner, 1934, fig. 3 a.)*Paratype*.—Same collection, tube and preparation no. 5. (Zeuner, 1934, fig. 3 b.)*Parts known*.—Complete males with appendages and wings.*Remarks*.—This form is closely related to *S. posthumus* Ramme, from the mountains of Montenegro, where it has been found in the same locality with *Podismopsis relictus* Rme. It is possible that *S. posthumoides* and *S. posthumus* are members of a subspecies-group, especially since all the more remarkable characters distinguishing them from other *Stenobothrus* are common to both forms. Since neither of them has been found outside the type-locality, however, it is impossible to arrive at a decision regarding the specific or subspecific status of *S. posthumus* and *S. posthumoides*. Moreover, there is a chance that one or the other of the less-known species of *Stenobothrus* is more closely related to this group than has been assumed. Pending a critical study of all the forms of the genus

therefore, it is advisable to treat *S. posthumoides* as a species.

An undeterminable head resembling *Stenobothrus*, from the Starunia deposit, may tentatively be referred to this species.

#### Genus CHORTHIPPUS Fieber.

1852. *Chorthippus* Fieber, in Kelch, Progr. kön. Gymnasium Ratibor, 1852: 1.

1910. *Chorthippus* Fieb., Kirby, Syn. Cat. Orth. iii. p. 184. (Genotype fixed.)

*Genotype*.—*Acrydium albomarginatum* de Geer, 1773.

*Distribution*.—Recent: Holarctis. Pleistocene: Polish Carpathians.

#### \**Chorthippus* cf. *mollis* (Charpentier).

##### (a) Male.

\*1934. *Chorthippus* (s. l.) sp. I., Zeuner, Starunia, iii. p. 8, fig. 7.

*Distribution*.—Upper Pleistocene: Starunia, near Stanislawow, Polish Carpathians.

*Typical specimen*.—Polish Academy of Sciences, Cracow. Starunia Collection, preparation no. 4.

*Parts known*.—Both elytra of a male specimen, anal areas missing.

*Remarks*.—Length of elytron 13.0 mm. Closely resembling *C. mollis* (Charp.), but precostal lobe wider and more sharply set off, cross-veins of costal area vertical to *Sc*, cross-veins between *Sc* and *R* denser, and discoidal cell wider.

##### (b) Female.

\*1934. *Chorthippus* sp. ex. aff. *hammarstræmi* Miram, Zeuner, Starunia, iii. p. 7, fig. 5.

*Specimen*.—Polish Academy of Sciences, Cracow. Starunia Collection, tube and preparation no. 9.

*Parts known*.—Thorax, abdomen, one elytron, and remains of other wings, of a female.

*Remarks*.—This female is tentatively associated with the male specimen just referred to. The valves of its ovipositor are toothless, as in most *Chorthippus*, and relatively slender and prominent. The elytra reach nearly to the end of the abdomen. They are fairly broad and agree in the shape of the apex fairly well with the

male specimen mentioned. Discoidal cell only half as long as the elytron. The precostal lobe is very distinct. Length of elytron, 12·8 mm.

Since I described this specimen in 1934, comparing it with *C. hammarstrœmi* Miram and related species, I have been able to compare it with specimens of several species of this group. It thus has become evident that the fossil belongs to the group of *C. biguttulus* L. rather than to any other, though it is distinct from all the species with which I am familiar. It is possibly the female of the species of the *Starunia Chorthippus*, represented by the male no. 4, which it suits in size, type of venation and shape of the apex.

*\*Chorthippus* cf. *angulatus* Tarbinsky.

\*1934. *Chorthippus* (s. str.) *angulatus* Tarb., Zeuner, *Starunia*, iii. p. 7.

\*1934. Pronotum, Zeuner, *Starunia*, iii. p. 12.

*Distribution*.—Upper Pleistocene: *Starunia*, near Stanislawow, Polish Carpathians.

*Typical specimen*.—Polish Academy of Sciences, Cracow. *Starunia* collection, tube and preparation no. 18.

*Parts known*.—Thorax, abdomen, elytra, hind wings, middle and hind legs of a male.

*Description*.—End of abdomen obtusely rounded. Hind femora slender. Hind knee dark. Elytron reaching the end of the abdomen, hind wing considerably shorter. Elytron slender, strongly pointed. Precostal lobe little prominent, *C* forming the fore margin in the distal half of the elytron. Costal area hardly widened. *CuA* and *CuP* separate. *2A* and *3A* not fused distally. Cross-venation loose but regular, membrane light brownish yellow, transparent. Length of elytron 10·0 mm., of hind femur 9·0 mm.

*Remarks*.—The preserved parts of this fossil agree completely with *Chorthippus angulatus* Tarbinsky, 1927, which occurs in Turkestan. This species belongs to the group of *Chorthippus dorsatus* Zett., and it can be said with certainty that the fossil belongs to this group. One hesitates, however, to identify it specifically with *Ch. angulatus*, which is found in the warm steppe of Turkestan, though it has to be admitted that in none of the available characters does it differ from this species.

An isolated pronotum, reminiscent of *Ch. dorsatus*, may tentatively be referred to this species.

*\*Chorthippus cf. parallelus Zetterst.*

\*1934. *Chorthippus* sp. II., Zeuner, Starunia, iii. p. 8.

*Distribution.*—Upper Pleistocene: Starunia, near Stanislawow, Polish Carpathians.

*Fossil specimen.*—Polish Academy of Sciences, Cracow. Starunia Collection, tube and preparation no. 21.

*Parts known.*—Male abdomen with parts of metasternum, both hind wings, and incomplete right elytron.

*Description.*—Abdomen extended after death, 12 mm. long. Back of abdomen light-coloured, sides dark. End of abdomen blunt and rounded.

Elytron with a venation reminiscent of *Ch. parallelus* Zett., but apex missing. It is impossible, therefore, to identify the species. The elytron is wider than that of *Ch. cf. angulatus* (max. width 2.6 mm. compared with 2.0 mm.), which renders it likely that this fossil belongs to the group of *Ch. parallelus* in which the wings and the elytra tend to become shortened. The two most probable species are *Ch. parallelus* Zett. and *Ch. montanus* Charp. (= *longicornis* Latr.).

*\*Chorthippus, spec. indet.*

\*1934. *Stenobothrus* n. sp. ? Zeuner, Starunia, iii. p. 6, fig. 4.

*Distribution.*—Upper Pleistocene: Starunia, near Stanislawow, Polish Carpathians.

*Fossil specimen.*—Polish Academy of Sciences, Cracow. Starunia Collection, tube and preparation no. 6.

*Parts known.*—Both pairs of wings, squashed abdomen and hind legs of a female.

*Description.*—Abdomen with black sides. Valves of ovipositor short and stout, all four with a tooth on the outer side. Terminal hook short.

Hind femora 11 mm. long. Knee black. Hind tibiae with black spines.

Elytra 15.8 mm. long, comparatively wide. Fore margin evenly curved (fig. 1), precostal lobe very slight, almost absent. Discoidal cell open, *M* and *CuA* being undivided and disappearing in the network of cross-veins distally. Cell narrow. *2A* and *3A* separate. A colour-

less patch in the distal fourth of *M* indicates the position of a whitish spot. The apex is slightly pointed, its costal and anal margins being fairly straight and converging.

Hind wings fully developed, but venation not straight, somewhat irregular, as in species in which the reduction of the power of flight has begun.

*Remarks.*—This is a puzzling specimen. The toothed valves of the ovipositor would assign it to *Stenobothrus* according to the keys, but they are also occasionally found in *Chorthippus*, though in a less developed condition. The character, therefore, cannot be regarded as absolute. The precostal lobe of the elytron is almost absent. This, together with the toothed valves, induced me to regard this fossil as a *Stenobothrus* in 1934. I have since re-examined the venation and found that in every respect it agrees with that of a macropterous specimen of *Chorthippus parallelus* Zett., particularly in the somewhat

Fig. 1.



*Chorthippus*, sp. indet., ♀.

irregular cross-venation (typical of macropterous specimens of normally mesopterous species) and the open discoidal cell. The shape of the apex also suits this species. The only difference in the elytron is in the precostal lobe, which is much slighter in the fossil than normally in the Recent species †. This difference and the presence of teeth on the valves of the ovipositor prevent me from identifying the fossil with *Ch. parallelus*, which is the commonest grasshopper of Europe and ranges so high in the mountains that one would expect to encounter it in the Pleistocene fauna of Starunia.

† In a British specimen of *Ch. parallelus*, f. *macroptera*, this lobe is exactly as inconspicuous as in the fossil. This, however, is exceptional.



Summarizing the arguments as to the systematic position of this fossil, the toothed valves and the smallness of the precostal lobe speak for *Stenobothrus*, but the open cell and the character of the venation in general against it. The venation both of elytra and hind wings agrees with *Chorthippus*, particularly *Ch. parallelus* Zett., f. *macroptera* (not with *Ch. montanus* Charp., syn. *longicornis* Latr.), and so does the shape of the apex of the elytra, but the smallness of the precostal lobe and the toothed valves, though not strictly impossible, would be unusual features in a *Chorthippus*.

The venation plainly excludes the fossil from *Stenobothrus*, and I therefore prefer to place it in *Chorthippus*.

#### Genus GOMPHOCERUS Thunberg.

1816. *Gomphocerus* Thunberg, Mém. Acad. Sci. St. Pétersb. v. p. 221.  
 1819. *Gomphocerus* Leach's MSS. *Gomphoceros* Thunb., Samouelle, Ent. useful Comp. p. 219. (Mentions only British species, *G. rufus* (L.).)  
 1835. *Gomphocerus* Latreille, Brullé, in Audouin, Hist. nat. Ins. ix. p. 224, footnote.  
 1835. Les Gomphocères, Brullé, in Audouin, Hist. nat. Ins. ix. p. 229. (Type: *Gryllus sibiricus* Fab.)  
 1848. *Æropus* Gistel, Naturgesch. Tierr. höh. Schulen, p. 137. (For *G. sibiricus* (L.).)  
 1910. *Gomphocerus* Thunb., Kirby, Syn. Cat. Orth. iii. p. 154. (Type: *Gryllus locusta rufus* L.)  
 1931. *Æropus* Gistel, Uvarov, Eos, vii. p. 85. (Type of *Gomphocerus*: *rufus*.)  
 1931. *Gomphocerus* Thunb., Tarbinsky, Bull. Inst. contr. Pests Diseases, i. p. 128. (Two species, *G. sibiricus* and *G. rufus*.)  
 1941. *Gomphocerus* Thunberg, Roberts, Trans. Amer. ent. Soc. lxvii. p. 22. (Establishes that Brullé, 1835, fixed the genotype, not Samouelle, 1819, and proposes *Gomphocerippus* new name for *G. rufus*.)

*Genotype*.—*Gryllus Locusta sibiricus* Linné, 1767.

*Distribution*.—Recent: Siberia, Tibet, Caucasus, Armenia, Asia Minor, Greece, Bulgaria, Serbia, Alps, Pyrenees, and mountains of Central Spain. Pleistocene: Carpathians.

#### \**Gomphocerus sibiricus* (Linné).

1767. *Gryllus Locusta sibiricus* Linné, Syst. Nat. ed. xii. p. 701.  
 1781. *Gryllus sibiricus* Fabricius, Spec. Ins. i. p. 368.  
 1813. (*Gryllus*) *sibiricus* Houttuyn, in Stoll, Repr. Spect. Phasm., etc., register, p. 12. (Misspelling.)

1835. *Gryllus sibiricus* Fab., Brullé, in Audouin, Hist. Nat. Ins ix. p. 229.  
1910. *G. sibiricus* Linn., Kirby, Syn. Cat. Orth. iii. p. 155.  
1931. *Ætropus sibiricus*, Uvarov, Eos, vii. p. 85.  
1931. *Gomphoceris sibiricus* (Linn.), Tarbinsky, Bull. Inst. contr. Pests Diseases, i. p. 131.  
\*1934. *Ætropus sibiricus* Linné, Zeuner, Starunia, iii. p. 9. (Fossil.)  
\*1934. *Chorthippus*, sp. III., Zeuner, Starunia, iii. p. 8, fig. 6. (Fossil.)  
1941. *Gomphoceris sibiricus* (Linnaeus), Roberts, Trans. Amer. ent. Soc. lxvii. p. 22. (Misspelling.)

*Synonymy*.—The synonymy of the Recent species has been given here in order to establish whether the spelling used by Roberts (1941) is correct or not.

*Distribution*.—Recent : see genus. Upper Pleistocene : Starunia, near Stanislawow, Polish Carpathians.

*Fossil specimens*.—Polish Academy of Sciences, Cracow. Starunia Collection, tube no. 12 (male), and preparation no. 1 (female).

*Parts known*.—Fossil male : head without antennæ, pronotum, thorax, base of abdomen, remnants of wings, right fore leg, middle legs and hind femur. Fossil female : right elytron, anal area missing, apex damaged.

*Description*.—Male specimen : pronotum 4.1 mm., comparatively short, prozona only slightly inflated. Anterior tibia inflated as in all races of the species, but less so than in the Recent alpine subspecies, *G. s. helveticus* Uv. Hind femur 11.0 mm. (in a *G. s. helveticus*, which agrees with the fossil in the length of the pronotum, 10.5 mm.). Middle femur 4.2 mm. (*G. s. helveticus* 4.2 mm.).

Female specimen : precostal lobe very pronounced. Just proximally of the end of the discoidal cell there are three cross-veins between *R* and *M*, closely grouped together. Discoidal cell narrow, with four brown spots, with fairly regular cross-veins, much longer than half the wing. *CuA* and *CuP* separate. Beyond the end of the cell lies an indistinct brown spot followed by a white patch and an oblique brown double spot. Length of elytron 11 mm. Note that the figure in Zeuner (1934) is upside down.

*Remarks*.—The male is undoubtedly a *G. sibiricus*. It agrees in its proportions fairly well with *G. s. helveticus*, but the pronotum and the fore tibia are reminiscent of *G. s. armeniacus* Uv. The female elytron is tentatively

referred to this species, with which it agrees better than with any *Chorthippus*, though this may not mean much, the differences being generally slight in female elytra. The discoidal cell is rather small for *G. sibiricus* and so is the whole elytron. This may be a subspecific character, especially since the male specimen also exhibits features distinguishing it from Recent European forms. There is no race of *G. sibiricus* in the Carpathians at present.

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XXVI.—*New Species of the Genus Erystus Jac. (Col., Halticinae)*. By G. E. BRYANT, F.R.E.S., Imperial Institute of Entomology.

THE genus *Erystus* has now been recorded as feeding on cotton in Flores. At present it has a range from Tenasserim to Flores. It has an unusual flattened appearance, with the sides of the elytra more or less explanate, and is easily distinguished from other Halticinae. I now describe four new species, bringing the total to eleven. The types are in the British Museum.

*Erystus andamanensis* Mlk.—Fauna Brit. Ind. Col. Chrys. 1926, p. 271. Andaman Is.

*Erystus banksi* Wse.—Philipp. Journ. Sci. v. 4, 1910, p. 266. Luzon.

*Erystus celebensis* Jac.—Ann. Mus. Civ. Gen. 2nd Series, ii. 1885, p. 40. Celebes.

*Erystus clypeatus* Jac.—Notes Leyd. Mus. ix. 1887, p. 232. Timor.

*Erystus gossypii*, sp. n. Flores.

*Erystus javanensis*, sp. n. Java.

*Erystus podagroides* Wse.—Deut. Ent. Zeit. 1892, p. 390. Ceram.

*Erystus quadripunctatus* Oglob.—Sbornik. ent. odd. Nar. Musea, v. Praze, 1927, p. 119. Tenasserim.

*Erystus saundersi*, sp. n. Singapore.

*Erystus villicus* Wse.—Deut. ent. Zeit. 1892, p. 391. Bangkei.

*Erystus wallacei*, sp. n. Sulu Is.

*Key to the Species of Erystus Jac.*

- 1 (12). Head and prothorax flavous, elytra almost entirely blue-black.
- 2 (5). Head and prothorax flavous, elytra not entirely blue-black.
- 3 (7). Sides of the elytra costate between the striae.
- 4 (8). The four terminal segments of the antennæ black..... *podagroides* Wso.
- 5 (2). Head and prothorax flavous, the elytra with a longitudinal black stripe.
- 6 (9). Elytra without maculae.
- 7 (3). The sides of the elytra not costate between the striae.
- 8 (4). The six terminal segments of the antennæ black..... *wallacei*, sp. n.
- 9 (6). The elytra each with two distinct maculae, one basal and the other behind the middle.
- 10 (11). Elytra not having the apex fuscous . *quadripunctatus* Oglob.
- 11 (10). Elytra without maculae, but having the apex fuscous ..... *javanensis*, sp. n.
- 12 (1). Elytra and remainder of the body entirely flavous.
- 13 (16). Antennæ entirely flavous.
- 14 (15). Elytra with the punctures of the striae double and irregular ..... *banksi*, Wso.
- 15 (14). Elytra with the punctures of the striae not double
- 16 (13). Antennæ with the basal segments flavous.
- 17 (23). Antennæ with the four basal segments flavous.
- 18 (19). Head feebly punctured..... *elypeatus* Jac.
- 19 (18). Head impunctate.
- 20 (25). Elytra elongate, the sides scarcely rounded.
- 21 (22). Sides of the elytra scarcely rounded, the margin explanate..... *gossypii*, sp. n.
- 22 (21). Sides of the elytra widest behind the middle ..... *andamanensis* Mik.
- 23 (17). Antennæ with the five basal segments flavous.
- 24 (29). Antennæ with more than five basal segments flavous.
- 25 (20). Sides of the elytra evenly rounded and explanate.
- 26 (27). Interspaces of the elytral striae not costate ..... *saundersi*, sp. n.
- 27 (26). Interspaces of the elytral striae not all costate.
- 28 (30). The three outer striae with the interspaces costate ..... *villicus* Wso.
- 29 (24). Antennæ with the seven basal segments flavous.
- 30 (28). Interspaces of the elytral striae all costate ..... *celebensis* Jac.

*HALTICINÆ.**Erythus javanensis*, sp. n.

Broadly ovate, flavous, with the seven terminal segments of the antennæ black, and the apical portion of the elytra tinged with fuscous.

Length 3.5 mm.

Head flavous, impunctate, transversely impressed between the eyes. Antennæ extending almost to the middle of the elytra, the four basal segments fulvous, the remainder black, clothed with short pubescence, the first segment the longest, and more dilated, about twice as long as the second, the third longer than the second, and the fourth a little shorter than the third, the remainder each about equal to the fourth, the apical segment acuminate. Prothorax flavous, very transverse, the sides rounded and feebly margined, the anterior angles slightly produced. Scutellum flavous, triangular, impunctate. Elytra flavous, with the apical portion tinged with fuscous, broader than the base of the prothorax, the sides behind the middle rounded to the apex, feebly explanate, and finely punctate-striate, the interspaces with very fine punctures. Legs and underside flavous, nitid, impunctate. Male with the antennæ slightly longer and thicker, the first segment of the anterior tarsi more dilated.

JAVA: (*Dr. van Hall*), three specimens; feeding on *Hibiscus*.

Allied to *E. clypeatus* Jac., from Timor, but differs in the impunctate head, and the apical fuscous patch on the apex of the elytra.

*Erythus gossypii*, sp. n. (Fig. 1.)

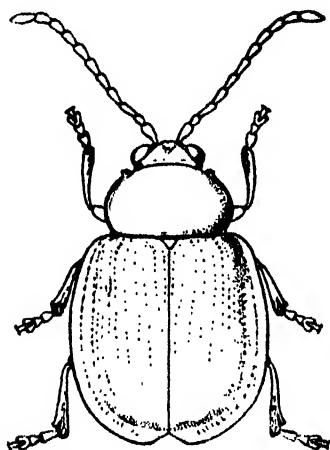
Broadly ovate, flavous, with the exception of the seven terminal segments of the antennæ black.

Length 3-3.5 mm.

Head flavous, broad, the vertex convex, smooth, and impunctate, a transverse impression between the eyes. Antennæ extending to the middle of the elytra, the four basal segments flavous, the remainder black, the first segment the longest, slightly club-shaped, nearly

twice as long as the second, the third slightly longer than the second, the remainder each about equal to the third, the seven terminal segments more pubescent. Prothorax flavous, very transverse, the sides strongly rounded, feebly margined, the anterior angles prominent, the surface convex, nitid, and very finely punctured. Scutellum flavous, triangular, impunctate. Elytra flavous, broader at the base than the prothorax, punctate-striate, widest behind the middle, than rounded to the apex, the side margins explanate, the striae with the interspaces with

Fig. 1.

*Erytus gossypii*, sp. n.

a few very fine punctures. Legs and underside flavous; the ventral segments of the abdomen punctured and pubescent.

FLORES Is. : Macemere, iv. 1925, six specimens; 6. v. 1926, three specimens.

Allied to *E. andamanensis* Mlk., but the elytra longer and narrower, and the antennae more slender.

Differs from *E. celebensis* Jac., in the punctures of the elytra not so strong, and the interspaces of the striae not carinate.

*Erystus wallacei*, sp. n.

Oval, fulvous, the elytra with a broad black longitudinal stripe, not extending to the apex, the six terminal segments of the antennæ black.

Length 4.5 mm.

Head fulvous, almost impunctate, a few punctures near the inner margin of the eyes, transversely impressed between the base of the antennæ. Antennæ extending just beyond the base of the elytra, the five basal segments fulvous, the remainder black, the first segment the longest, twice as long as the second, the third a little longer than the second, the fourth slightly shorter than the third, the fourth to the tenth all about equal, the eleventh slightly longer and acuminate. Prothorax fulvous, strongly transverse, very finely and closely punctured, the sides rounded, narrowly margined, the anterior angles produced. Scutellum fulvous, triangular, impunctate. Elytra with a broad longitudinal black stripe between the third and seventh striæ, margined with fulvous, punctate-striate, the punctures not very strong or close, the interspaces with very fine punctures. Legs and underside fulvous.

SULU : (*A. R. Wallace*) (Baly Coll., British Museum), three specimens.

Allied to *E. podagroides* Wse., from Ceram, but differs in the elytra having a longitudinal stripe, and in not being almost entirely blue-black.

*Erystus saundersi*, sp. n.

Broadly ovate, flavous, except the six terminal segments of the antennæ black, head impunctate, prothorax very finely and feebly punctured, elytra strongly punctate-striate.

Length 3.5-4 mm.

Head flavous, nitid, impunctate a triangular impression between the eyes. Antennæ extending slightly beyond the base of the elytra, the five basal segments flavous and nitid, the six terminal segments black, clothed with short pubescence, the basal segment the longest and slightly club-shaped, twice as long as the second, the third slightly longer than the second and fourth, the remainder each about equal to the fourth. Prothorax

flavous, nitid, very finely and feebly punctured, transverse, the sides strongly rounded and narrowly margined, the anterior angles slightly oblique. Scutellum flavous, triangular, impunctate. Elytra flavous, slightly wider at the base than the prothorax, the sides rounded, widest at their middle, and rounded at the apex, strongly punctate-striate, the punctures large and evenly spaced, the margin strongly explanate and slightly costate between the striæ at the sides. Legs flavous, the male with the basal segment of the anterior tarsi dilated. Underside flavous, nitid, with the exception of the ventral segments of the abdomen feebly punctured.

SINGAPORE : (C. J. Saunders), eight specimens.

Allied to *E. andamanensis* Mlk., but with the sides of the elytra more rounded, and the striæ with the punctures coarser.

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## BIBLIOGRAPHICAL NOTICES.

*Popular Handbook on Indian Birds.* By HUGH WHISTLER.  
Third Edition, revised and enlarged. Pp. i-xxviii + 1-549,  
6 coloured, 15 black and white plates, and 105 text-figures.  
Edinburgh : Gurney & Jackson. Price 18s. 6d.

To write a good popular account of the birds of a country is the test of a good ornithologist. All scientific matter must be disguised in such a way that the tiro is not put off, but still the information must be available for those who want it.

That Mr. Whistler has been very successful is shown by the fact that the present edition is the third since the book was first published in 1928. With each succeeding edition the whole book has been thoroughly revised and brought up to date and the number of birds increased. Although the author nominally writes about 300 of the commonest birds of India he really does a great deal more, since in the letter-press to each species he skilfully gives little hints of how to recognize different races and nearly allied species.

The illustrations have also been increased, and fortunately were completed before the death of that talented artist, Henrik Grönvold.



No country in the world has such a wealth of bird-life as India, nor is there such a great variety of types of country—from the deserts of Sind to the humid jungles of Malabar,—the undulating uplands of the Nilgiris or the heavy cultivated valley of the Ganges. Nevertheless, the author has made an admirable selection of species, and whether the book is consulted by the dweller in the plains or the visitor to the Himalayan Hill Station, there should be little difficulty in naming the commoner birds met with.

The short notes on habits add much to the interest of the book, and without doubt give assistance in identifying the different species.

*Check-List of Birds of the World.* Vol. IV: By JAMES LEE PETERS. Pp. i-xii+1-291. Cambridge, U.S.A.: Harvard University Press, 1941: London: Oxford University Press. Price 22s. 6d.

Few realize the amount of work necessary in writing a list of birds of the world, and pessimists predict that at the present rate of progress it will be years before Mr. Peters completes his task.

The author has been much handicapped by the absence of recent revisions of many of the non-passerine families, but now that he has nearly completed these, we hope the delays will be shorter.

The present volume deals with the Plantain-eaters, Cuckoos, Swifts, and Owls, and of these the last family has had to be completely revised. Many footnotes discuss interesting points of nomenclature, identify and add much to the usefulness of the book.

In his Introduction Mr. Peters points out that if his four volumes be compared with those parts of Sharpe's 'Handlist' dealing with the same families, it will be found that there are 261 fewer genera, but 1480 more species and subspecies. To the systematist and student of geographical distribution Mr. Peters's volumes are quite indispensable.

# THE ANNALS AND ~~MAGAZINE~~ OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 53. MAY 1942.

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XXVII.—*New Species of Staphylinidæ (Col.) collected by the Coryndon Museum Expedition to the Chyulu Hills.*  
By MALCOLM CAMERON, M.B., R.N., F.R.E.S.

*Eleusis unicolor*, sp. n.

Shining, black. Antennæ and legs reddish yellow, the femora infusate. Length 3.5 mm.

Head transverse suborbicular, slightly wider than the thorax, the eye as long as the post-ocular region, with a few small obsolete punctures, the ground-sculpture well marked. Antennæ rather slender, 3rd segment as long as 2nd, 4th very slightly longer than broad, 5th as long as broad, 6th to 10th slightly transverse, not increasing in width, the 11th as long as the 9th and 10th together. Thorax as long as broad, the sides rather strongly retracted to the base and with an obsolete tooth a little behind the middle; along the centre with fine impressed line not reaching either the anterior or posterior borders, on each side somewhat flattened, the sculpture as on the head. Elytra longer than the thorax (3 : 2), impunctate, with well-marked more or less longitudinal ground-sculpture. Abdomen almost impunctate, with similar but transverse ground-sculpture.

Chyulu Hills, altitude 5600 feet. June, 1938. Unique. British Museum Collection.

*Ann. & Mag. N. Hist. Ser. 11. Vol. ix.* 23

*Lispinus coryndoni*, sp. n.

Moderately shining; head and thorax dark ferruginous red, the former lighter in front; elytra pitchy black, the base shoulders and suture reddish; abdomen black, the posterior margins of the segments narrowly rufescent. Antennæ and legs reddish yellow. Length 2.5 mm.

Near *externepunctatus* Epp., but differs in the darker colour, thinner antennæ, coarser puncturation of the foreparts, stronger more or less longitudinal and wavy ground-sculpture, as in *leonensis* Bernh. but yet stronger. Head bi-impressed in front, finely and rather sparingly punctured and with normal coriaceous ground-sculpture, posteriorly much less finely and rather closely punctured and with a fine more or less longitudinal wavy ground-sculpture. Antennæ shorter and thinner than in *externepunctatus*, the 4th and 5th segments about as long as broad, the following transverse. Thorax slightly transverse (1.75:1.5), the sides retracted behind but straighter than in *externepunctatus*, along the middle with an extremely fine impunctate line, the disc without impressions and the lateral impressions feeble, much less marked than in *externepunctatus*, the punctures rather close and much coarser than in that species. Elytra longer than the thorax (2:1.5), as long as broad, the punctures less close, smaller and much less deep than on the thorax. Abdomen sparingly and irregularly punctured, coriaceous, but the first four visible tergites in the middle practically without ground-sculpture and more shining.

Chyulu Hills, altitude 5600 feet. June, 1938. Unique. British Museum.

*Megarhtrus monticola*, sp. n.

Rather dull; head and abdomen black, the latter with the posterior margins of the last two tergites yellowish; thorax pitchy black, the side margins rather broadly reddish yellow; elytra dark yellowish brown. Antennæ black. Legs reddish yellow. Length 3 mm.

In build very like *sinuatocollis* Lac., but larger, broader and rather more depressed, at once distinguished by the longer and more slender antennæ, all the segments distinctly longer than broad. Head coarsely and rugosely punctured. Antennæ with the 4th segment as long as the 3rd, 5th to 7th longer, equal amongst themselves, 8th to 10th

gradually shorter, 11th longer than the 10th. Thorax strongly transverse (4.2 : 2), formed as in *sinuatocollis* but with the sides more broadly explanate, along the middle deeply sulcate, coarsely closely and asperately sculptured. Elytra twice as long as the thorax, gradually widened towards the apex, with similar but coarser sculpture. Abdomen rather closely, finely but asperately punctured.

Chyulu Hills : altitude 5600 feet. June, 1938. Type in British Museum Collection.

*Omalius* (s. str.) *montivagans*, sp. n.

Rather shining ; head and abdomen black ; thorax dark reddish brown, lighter at the sides ; elytra brownish yellow, more or less extensively infusate at the sides and behind. Antennæ black, the first five segments and legs reddish yellow. Length 2.75 mm.

In build much resembling *madegassa* Bernh., but more shining, more coarsely punctured, the antennæ stouter. Head closely, rather coarsely punctured, smooth in front. Antennæ with the penultimate segments transverse. Thorax transverse (2.75 : 2), the sides rounded in front, retracted and slightly sinuate behind, the disc deeply bi-impressed from the base to a little beyond the middle, the sides impressed posteriorly, the punctures close and moderately coarse as on the head, the ground-sculpture very obsolete. Elytra a half longer than the thorax, the punctures equally close but a little larger ; ground-sculpture absent. Abdomen coriaceous, very finely and obsoletely punctured.

Chyulu Hills : altitude 5600 feet. July, 1938. Type in the British Museum.

*Oxytelus* (*Anotylus*) *monticola*, sp. n.

Black, moderately shining. Antennæ black. Legs reddish yellow, the femora and tibiæ sometimes a little infusate apically. Length 4-4.5 mm.

Build of *sculpturatus* Gr., but much less shining, the antennæ a little shorter and stouter. Head in ♂ short, transverse, as broad as the thorax, the post-ocular region longer than the eye, rounded and a little dilated, the anterior margin in the middle slightly produced as a little plate, its anterior border scarcely emarginate ; the surface between the antennal tubercles depressed, strongly

coriaceous and with a few small punctures, on the vertex with a median sulcus, on each side feebly impressed and closely, moderately coarsely punctured, externally strongly striate: in the ♀ the head is smaller, narrower than the thorax, the post-ocular region not dilated and about as long as the eye, the anterior margin gently rounded, the coriaceous frontal area without punctures, the sculpture elsewhere as in the ♂. Antennæ short and stout, the 4th segment small, transverse, 5th to 10th gradually increasing in width, 11th as long as the 9th and 10th together. Thorax transverse (3.5 : 2.5 in ♂, 3 : 2 in ♀), trapezoidal, the disc with three deep sulci extending from the base to the anterior border, the median broader in front, towards the sides distinctly impressed, much more coarsely punctate-striate than in *sculpturatus*. Elytra a little longer than the thorax, closely punctate-striate, the rugæ coarser than in *sculpturatus*. Abdomen finely coriaceous, finely, moderately closely punctured.

♂: 6th sternite with a small reddish-yellow tubercle at the middle of the posterior margin.

Chyulu Hills: altitude 5600–6600 feet. Type in the British Museum Collection.

*Stenus (Hypostenus) chyuluensis*, sp. n.

Moderately shining, black. Antennæ with the first four segments reddish yellow, the following sometimes infusate. Legs reddish yellow. Length 6 mm.

In build somewhat resembling *similis* Hbst., but larger and more robust, the antennæ much longer, the puncturation much coarser, the legs differently coloured, the head more depressed between the eyes; from *vastus* Bernh. it differs in the longer antennæ, flatter interocular space, much coarser puncturation, especially of the abdomen and the more scanty pubescence. Head as broad as the elytra, depressed between the eyes, at the middle of the base with a small smooth slightly raised area, elsewhere coarsely and rugosely punctured. Antennæ long and slender, extending to the base of the elytra, the 3rd segment very long, the 4th and following decreasing in length, the 10th and 11th stouter than the preceding. Thorax longer than broad (4 : 3.3), widest at the middle, the sides gently rounded in the anterior half, straight and rather more retracted posteriorly, the puncturation close,

rugose, rather coarser than on the head. Elytra as long as but broader than the thorax, transverse (4.75 : 4), coarsely closely rugosely punctured like the thorax. Abdomen with the first four visible tergites transversely impressed at their base, coarsely, closely and rugosely punctured but less coarsely than the elytra, the 5th and 6th more finely and less closely punctured and with a fine coriaceous ground-sculpture, the rest of the insect without ground-sculpture.

♂ : 6th sternite with deep arcuate emargination.

Chyulu Hills : altitude 5600 feet. Type in British Museum.

*Stenus (Hypostenus) corydoni*, sp. n.

Moderately shining, black. Antennæ yellow, the last four segments blackish. Legs reddish yellow. Length 3.5 mm.

Size and build of *turneri* Bernh., but a little more robust, not quite so shining, the antennæ longer, the puncturation throughout very similar, the head without the shining plaque on the disc. Head as broad as the elytra, feebly broadly bisulcate, the raised central area without smooth plaque, coarsely and closely punctured all over. Antennæ slender, not extending to the base of the thorax, 3rd segment twice as long as 2nd, 4th to 10th all longer than broad, decreasing in length, the 11th as long as the 10th. Thorax slightly longer than broad (2.75 : 2.3), widest at the middle, the sides equally retracted in front and behind, coarsely and closely punctured like the head. Elytra slightly longer (3 : 2.75) than the thorax, slightly broader than long, as closely but more coarsely punctured. Abdomen closely and coarsely punctured on the first three visible tergites, as closely but more finely on the following. Pubescence short, white, very scanty on the fore-parts, more evident on the abdomen.

Chyulu Hills : altitude 5600 feet. June, 1938. Unique. British Museum Collection.

*Medon* (s. str.) *æthiopicus*, sp. n.

Black, shining, the fore-parts more so than the abdomen, the posterior margin of the 7th and most of the 8th tergite reddish yellow. Antennæ reddish. Legs reddish yellow. Length 5 mm.

Head subquadrate, slightly transverse, as broad as the thorax, the posterior angles rounded, the base truncate, the temples twice as long as the eyes, scarcely widened towards the base, in the middle with narrow impunctate space, otherwise closely covered with moderate umbilicate punctures; ground-sculpture absent. Antennæ rather long and slender, all the segments longer than broad, gradually decreasing in length from the 4th, the penultimate only slightly longer than broad, the 11th a little longer than the 10th. Thorax transverse (3.5 : 3), trapezoidal, along the middle with rather broad impunctate space, elsewhere with similar sculpture to the head; ground-sculpture absent. Elytra longer than the thorax (4 : 3), as long as broad, the puncturation as close as on the fore-parts but not quite so coarse. Abdomen finely and rather closely punctured, grey pubescent and without ground-sculpture. The fore-parts sparingly pubescent.

♂ : unknown.

Chyulu Hills : altitude 3800 feet. April, 1938. Unique. British Museum Collection.

*Lithocharis simplex*, sp. n.

Moderately shining; head black; thorax and elytra yellowish red, the latter extensively infuscate; abdomen pitchy black, the posterior margins of the tergites narrowly and obscurely rufescent. Antennæ with the first six segments pitchy black, the following reddish yellow. Palpi and legs reddish yellow. Length 3.5 mm.

♂ : in build much resembling *nigriceps* Kr., but with differently coloured antennæ, different sculpture of the head and thorax, darker elytra and abdomen. Head as long as broad, the posterior angles rather broadly rounded, narrower than the thorax, the eyes much shorter than the post-ocular region; puncturation close and fine, much finer and more superficial than in that species, the antennæ, however, scarcely differing in structure. Thorax as long as broad, the sides retracted towards the base, without smooth median line, the whole surface closely covered with fine granules as in *sororcula* Kr., but closer. Elytra longer than the thorax (5.5 : 4.5), as long as broad, with fine close granular sculpture. Abdomen very finely and closely punctured, finely pubescent. Anterior tarsi strongly dilated : 6th sternite feebly arcuately emarginate.

Differs from *sororcula* Kr., ♂, in the smaller rounded head, smaller eyes, colour, etc.

Chyulu Hills : altitude 5600 feet. June, 1938. Unique. British Museum.

*Philonthus satanus*, sp. n.

Shining, black, the abdomen slightly iridescent ; thorax with dorsal row of four small punctures. Antennæ black, the base of the 2nd segment reddish yellow, the 11th obscurely reddish ; palpi pitchy. Legs yellowish red, the tibiæ blackish. Length 9 mm.

In build much like *coruscus* Gr., but with smaller eyes and in all other respects different. Head narrower than the thorax, slightly transverse, roundish, the eyes a good deal shorter than the post-ocular region, the median inter-ocular punctures widely separated, between the posterior margin of the eye and the neck with three moderate punctures, the post-ocular region with two or three others yet smaller ; ground-sculpture very fine, transverse. Antennæ rather slender, the segments longer than broad, decreasing in length, the penultimate only slightly longer than broad. Thorax very slightly transverse (6.5 : 6), narrowed towards the front, the dorsal punctures equidistant, externally with two more, towards the anterior angles with two others ; ground-sculpture as on the head. Elytra a little longer and broader than the thorax, transverse (8 : 7), with moderately coarse, close, transversely rugulose sculpture and short greyish pubescence. Abdomen rather sparingly punctured, with long black pubescence. First segment of posterior tarsi much longer than the last.

♂ : unknown.

Chyulu Hills : altitude 5200 feet. May, 1938. Unique. British Museum Collection.

*Philonthus diabolicus*, sp. n.

Shining, black, abdomen moderately iridescent ; thorax with dorsal row of four punctures. Antennæ black, the last two segments obscurely reddish. Palpi pitchy. Legs yellowish red, the tibiæ blackish. Length 8 mm.

♂ : Smaller than *satanas* Cam., the head broader subquadrate, eyes smaller, antennæ shorter, abdomen much more closely punctured. Head nearly as broad as the



thorax, transverse, subquadrate, the eyes much shorter than the post-ocular region, the front bi-impressed, the median inter-ocular punctures widely separated, between the posterior margin of the eye and the neck with four or five small punctures, the post-ocular region with two or three others, before the neck with a pair of larger punctures; ground-sculpture fine, transverse. Antennæ rather short, not reaching the base of the thorax, the 4th and 5th segments scarcely longer than broad, the 6th to 10th gradually more transverse. Thorax slightly transverse (5.75 : 5), narrowed towards the front, with four small equidistant punctures in the dorsal row and two others externally; ground-sculpture as on the head. Elytra longer than the thorax (6 : 5), slightly transverse, closely moderately coarsely punctured, finely grey pubescent. Abdomen finely, rather closely punctured, with longer and coarser hairs than on the elytra. First segment of the posterior tarsi longer than the last.

♂: anterior tarsi dilated: 6th sternite triangularly impressed at the middle of the posterior margin and rectangularly excised.

Chyulu Hills: altitude 5600 feet. July, 1938. Unique, British Museum Collection.

*Philonthus nigricolor*, sp. n.

Much like *varius* Gyll. in general facies but smaller (6 mm.) and narrower, but with broader head and the elytra without metallic reflex. Head as long as broad, orbicular, narrower than the thorax, the eyes shorter than the post-ocular region, the sides with some long black setæ. Antennæ more slender than in *varius* but with the penultimate segments distinctly transverse. Thorax longer than broad (4.5 : 4), with sericeous reflex, narrowed towards the front, with dorsal row of four moderate equidistant punctures and two others externally, the sides with three long black setæ. Elytra as long as but broader than the thorax, as closely but less deeply punctured than in *varius*, the sides with six long black setæ. Abdomen more finely and less closely punctured than in that species and the pubescence less close but of similar character, the sides setiferous. Legs dark, only the tarsi reddish; the 1st segment of the posterior tarsi shorter than the last.

Chyulu Hills : altitude 5600 feet. June, 1938. Unique. British Museum.

*Philonthus (Gabrius) chyuluensis*, sp. n.

Very near *thermarum* Aubé, but the colour of the thorax and elytra is darker, black or very dark reddish brown, the first two segments of the antennæ darker, yellowish brown, the head narrower and narrowed towards the front, the puncturation of the elytra scarcely differs from that species. Head longer than broad (2 : 1.5), a little narrower than the thorax ; thorax a little longer than broad, the sides scarcely retracted towards the front ; elytra slightly longer than the thorax : in other respects like *thermarum*, and were it not for the narrower and differently shaped head might be regarded as a dark form of that species. Length 3.3-4 mm.

Chyulu Hills : altitude 5600 feet. June and July, 1938. Type in the British Museum. Co-type in my collection.

*Philonthus (Gabrius) coryndoni*, sp. n.

Near *nigritulus* Gr., but more robust, the head as broad as long, as broad as the thorax, the antennæ scarcely differing in colour or structure ; thorax a little broader, more retracted in front ; elytra slightly longer than the thorax, much more coarsely and a little less closely punctured than in that species and of a dark reddish-brown colour. Length 4-5 mm.

♂ : a little larger and more robust than the ♀ ; 6th sternite with acute triangular excision at the middle of the posterior margin, which is largely filled in by membrane.

Chyulu Hills : altitude 5600 feet. June, 1938. Type in British Museum Collection.

*Staphylinus (Abemus) africanus*, sp. n.

Head and thorax shining, brassy ; elytra less shining and less strongly metallic ; abdomen black, moderately shining. Antennæ black. Legs pitchy black, the tarsi reddish. Length 8.5 mm.

Colour of fore-parts similar to *cupreus* Rossi, but smaller, the head and thorax much more strongly punctured, the

former differently shaped, the prothoracic epimera well developed. Head transverse, subquadrate, as broad as the thorax, closely and rather coarsely punctured. Antennæ with the 3rd segment a little longer than the 2nd, 4th as long as broad, 5th to 10th gradually more transverse. Thorax scarcely longer than broad, along the middle with rather broad impunctate space, elsewhere with puncturation very similar to that of the head. Elytra as long as the thorax, with close rugose sculpture less fine than in *cupreus* and with mixed yellow and black hairs. Abdomen rather closely, moderately finely punctured, with rather coarse, close uniform black pubescence. Head and thorax with scanty yellow hairs.

♂: 6th sternite with small arcuate emargination in the middle of the posterior margin.

Chyulu Hills: altitude 5600 feet. June, 1938. Type in British Museum Collection.

*Staphylinus (Pseudocypus) montanus*, sp. n.

Black, dull. Antennæ black the first two segments yellowish red, the first with a blackish marking above; palpi yellowish red. Anterior legs yellowish red, the middle and posterior black with reddish tarsi. Length 10.5 mm.

Head subquadrate, slightly transverse (8:7), very slightly narrower than the thorax, the posterior angles rounded, the eye as long as the temple, closely covered with moderately large umbilicate punctures. Antennæ moderate, the 4th to 10th segments gradually more transverse, the penultimate about a half broader than long. Thorax as long as broad, the sides feebly rounded, the posterior angles broadly rounded, the puncturation similar to that of the head, but not quite so coarse. Scutellum black, tomentose. Elytra as long as the thorax, with close moderately coarse rugulose sculpture. Abdomen closely, moderately coarsely punctured, with long, close black hairs, the 1st and 2nd visible tergites at the middle of the base with a very few golden hairs. The fore-parts with rather close greyish pubescence.

♂: 6th sternite with moderate arcuate emargination at the middle of the posterior margin.

Chyulu Hills : altitude 5600 feet. July, 1938. Type in the British Museum.

*Atheta (Acrotona) chyuluensis*, sp. n.

Moderately shining, black, the elytra yellowish brown or reddish brown. Antennæ black, the first four segments and legs reddish yellow. Length 2 mm.

In build and colour very similar to *fungi* Gr., but more robust, the antennæ similarly constructed but stouter, the 11th segment a little longer ; head and thorax much more closely and much less finely punctured, the ground-sculpture similar ; elytra less finely but less roughly punctured, abdomen as finely but rather more closely punctured than in that species. Middle tibiæ with moderately stout seta at the middle of the outer margin, the posterior with a shorter and weaker one.

♂ : 7th tergite in the middle a little before the posterior margin with a tubercle ; 8th with a pair of parallel keels, their posterior ends projecting beyond the posterior margin as little teeth. ♀ : 8th tergite with feeble arcuate emargination.

Chyulu Hills : altitude 5600 feet. June, 1938. Type in British Museum Collection.

*Aleochara (Polychara) imitator*, sp. n.

Shining black, the elytra with ill-defined reddish yellow marking extending obliquely from the base to the posterior margin, gradually increasing in width, leaving the sutural region triangularly black. Antennæ black, the first two segments pitch-black. Legs reddish yellow, the femora and tibiæ infusate. Length 3.5 mm.

In colour resembling *plagifer* Cam. (which should be referred to the subgenus *Polychara*), but with dark antennal base and darker femora and tibiæ, the head narrow, round, much narrower than the thorax (2.3 : 3), yet more finely and more sparingly punctured, the antennæ shorter, with rather more transverse penultimate segments. Thorax transverse (3.3 : 2), more narrowed towards the front than in *plagifer*, very finely and rather less-closely punctured than in that species. Elytra as long as the thorax, the posterior external angles rounded, a little less

closely, more finely and distinctly less roughly punctured than in *plagifer*. Punctuation of abdomen fine, moderately close and of similar character but not so close as in *plagifer*. The whole insect, like *plagifer*, without ground-sculpture.

Chyulu Hills: altitude 5600 feet. Unique. British Museum Collection.

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XXVIII.—*New Species of Chrysomelidæ (Halticinæ, Coleoptera) from Malaya, Borneo, New Guinea and N. Queensland.* By G. E. BRYANT, F.R.E.S. (Entomological Assistant Imperial Institute of Entomology).

[All the types in the British Museum.]

#### HALTICINÆ.

*Arsipoda papuana*, sp. n. (Fig. 1.)

Ovate, greenish-æneus, the four basal segments of the antennæ fulvous, all the femora and basal half of the tibiæ fulvous, head impunctate, prothorax very finely punctured, the elytra finely punctate-striate.

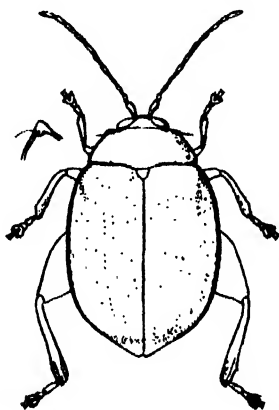
Length 6 mm.

Head dark greenish-æneus, impunctate, the front impressed on either side by a deep groove near the inner border of the eye. Antennæ filiform, extending to the middle of the elytra, the four basal segments fulvous, the terminal fuscous, the first segment club-shaped and more than twice as long as the second, the palpi fulvous. Prothorax greenish-æneus, nitid, very finely punctured, three times as broad as long, the sides rounded and converging from the base to the apex, the anterior angles produced and obtuse, containing a pore. Scutellum triangular-æneus, impunctate. Elytra greenish-æneus, rather broader than the prothorax, finely punctate-striate, the interspaces smooth, but with a few very fine scattered punctures. Legs with the femora fulvous, the tibiæ fuscous, except the basal half of the posterior pair, which is fulvous, the tarsi more or less fulvous, the hind tibiæ

slightly curved and the outer surface bicanaliculate. Underside dark æneous.

NEW GUINEA: Mafulu, 4000 ft., i. 1934 (*Miss L. E. Cheesman*), 1 specimen.

Fig. 1.



*Arsipoda papuana*, sp. n.

Allied to *A. wallacei* Baly, but differs in its metallic colour, legs not so pale, the abdomen not fulvous, and punctures on the prothorax much finer.

*Aphthona montana*, sp. n.

Body oblong, parallel-sided, the apex rounded. Black, with the exception of the antennæ, anterior and middle legs and hind tarsi flavous. Prothorax very finely punctured, the elytra finely and closely punctate-striate.

Length 2.5 mm.

Head black, impunctate, a longitudinal impression on the vertex. Antennæ flavous, extending a little beyond the middle of the elytra, the first segment twice as long as the second, club-shaped, the second about as long as the third but more rounded, the fourth slightly longer than the third, and about equal to each of the remaining terminal segments. Prothorax black, very finely punctured, the sides almost straight, feebly margined, the

anterior angles oblique. Scutellum black, impunctate, the apex rounded. Elytra black, wider at the base than the prothorax, punctate-striate, the punctures close and fine. Legs flavous, except the posterior pair, which have the femora and tibiæ black, all the tarsi flavous, the claws black. Male with the first segment of the anterior tarsi dilated. Underside black, the meso- and metasternum nitid, the ventral segment of the abdomen rugosely punctured, the first segment the longest.

PAPUA: Mt. Tafa, 8500 ft., ii. 1934 (*Miss L. E. Cheesman*), 23 specimens.

Somewhat allied to *A. nigrita* Mots., from Ceylon, but differs in the pale antennæ, punctate-striate elytra, and its larger size.

*Manobia papuana*, sp. n.

Body oblong, somewhat narrowed at the apex. Colour castaneous, with the sides of the elytra darker, the antennæ and legs flavous, the hind femora tinged with fuscous.

Length 2.5 mm.

Head castaneous, impunctate, feebly transversely carinate behind the insertion of the antennæ, extending to the inner margin of the eyes. Antennæ long and slender, extending beyond the middle of the elytra, flavous, the first segment long and club-shaped, the second shorter but thicker than the third, the third and fourth each about equal to the second, the fifth to the eleventh each a little longer than the fourth, the five terminal very slightly thickened. Prothorax castaneous, transversely quadrate, the sides straight but slightly contracted to the base, anterior angles obliquely truncate, the surface strongly but not closely punctured, a deep transverse impression near the base, strongly sinuate, containing some strong punctures. Scutellum small, triangular, impunctate. Elytra castaneous, the sides darker, a well-marked basal depression, the shoulders prominent, strongly punctate-striate, the punctuation diminishing towards the apex. Legs flavous, the posterior femora tinged with fuscous, the male with the basal segment of the anterior tarsus dilated. Underside castaneous, first

ventral segment of the abdomen the longest, the second to the fourth short and about equal.

PAPUA: Mt. Tafa, 8500 ft., ii. 1934 (*Miss L. E. Cheesman*), 15 specimens.

Allied to *M. abdominalis* Jac., from Mentawai Is., but differs in colour, longer antennæ, and strongly punctured prothorax.

*Crepidodera quadrimaculata*, sp. n.

Fulvous, the head and prothorax slightly darker, the elytra with four black maculæ, the antennæ with segments five to ten black, the apical segment flavous, the elytra punctate-striate.

Length 4 mm.

Head dark fulvous, impunctate, between the base of the antennæ an indistinct longitudinal carina. Antennæ extending to the middle of the elytra, the four basal segments fulvous, segments five to ten black, the apical segment flavous, elongate, the first segment longer and more thickened than the second, segments two to ten about equal to each other, segments five to ten slightly thickened and pubescent. Prothorax dark fulvous, impunctate, transverse, sides margined, slightly contracted in front, the anterior angles thickened and produced, the basal sulcus rather shallow, bounded on either side by a deep longitudinal depression. Scutellum fulvous, triangular, impunctate. Elytra elongate, gradually narrowed behind, fulvous, a black macula at the base and a large one at the middle, not extending to the suture or side-margin, punctate-striate. Legs fulvous, the tarsi with the apical segment paler, the male with the first segment of the anterior tarsi dilated. Underside fulvous.

SOUTH-EAST QUEENSLAND: Tambourine Mountains, 2-9. iv. 1938 (*R. E. Turner*), 3 specimens.

Unlike any Australian described species, on account of the black markings. May be placed near *C. parallela* Baly, from Sydney.

*Eudolia brunnea*, sp. n. (Fig. 2.)

Entirely chestnut-brown with the exception of the four apical segments of the antennæ black, the eleventh segment with the apex tinged with fulvous, the head and

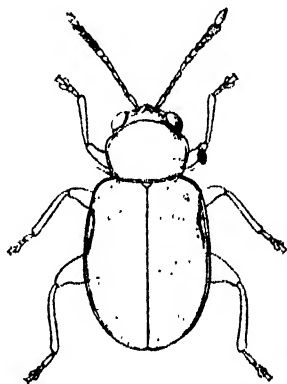


prothorax impunctate, the elytra feebly and irregularly punctured.

Length 3 mm.

Head chestnut-brown, impunctate, nitid, the inter-antennal space raised in a longitudinal ridge, and a transverse ridge between the eyes. Antennæ extending a little beyond the base of the prothorax, the seven basal segments fulvous, the four terminal segments black, with the apex of the eleventh tinged with fulvous, the basal segment the longest and slightly club-shaped, the second and third about equal to each other, and each about half as long as the first, the fourth slightly longer than the third, the fifth to the tenth about equal, each a little shorter than the fourth, the apical segment slightly

Fig. 2.



*Eudolia papuana*, sp. n.

longer and acuminate. Prothorax chestnut-brown, broader than long, the sides slightly contracted at the base and feebly margined, impunctate, nitid. Scutellum chestnut-brown, triangular, impunctate. Elytra chestnut-brown, broader at the base than the prothorax, finely punctured in somewhat ill-defined rows, the sides parallel and rounded at the apex, the basal portion strongly raised at the shoulders. Legs entirely fulvous, the posterior femora not very incrassate. Underside chestnut-brown, nitid.

W. SARAWAK : Mt. Matang, xii. 1913 (*G. E. Bryant*), 2 specimens ; Penang I., x. 1913 (*G. E. Bryant*), 1 specimen.

Differs from the four previously described species in the elytra not being metallic.

*Eudolia malayana*, sp. n.

Shining chestnut-brown, the elytra darker than the head and prothorax, the five basal segments of the antennæ in the male and legs flavous, male with the six terminal segments of the antennæ black and more dilated, the female with the three terminal segments of the antennæ black. Head and prothorax impunctate, the elytra strongly punctured.

Length 2.5–3 mm.

*Male and female*.—Head chestnut-brown, nitid, impunctate, the interantennal space with a slight longitudinal carina, transversely impressed between the eyes. Antennæ extending a short way beyond the base of the prothorax. Male with the five basal segments flavous, the basal segment the longest, the six terminal segments black, the seventh to tenth transversely broadened, the apical segment more elongate and rounded at the apex. Female with only the three apical segments black and not dilated as in the male. Prothorax chestnut-brown, paler than the elytra, nitid, impunctate, transverse, slightly contracted, at the base, the sides feebly margined. Scutellum chestnut-brown, triangular, impunctate. Elytra deep chestnut-brown, broader than the base of the prothorax, the sides parallel and rounded at the apex, strongly punctured in irregular rows, the humerus strongly raised, convex. Legs flavous, the posterior femora not very incrassate. Under-side chestnut-brown, nitid, the abdomen with the ventral segments two to four about equal.

MALAY PENINSULA : Perak (*W. Doherty*, Fry Collection, British Museum), 3 ♂♂ and 3 ♀♀.

Closely allied to *E. brunnea* Bry., but differs slightly in colour, the punctuation of the elytra stronger, and the colour of the antennal segments different.

**XXIX.**—*New or little-known Tipulidæ (Diptera).*—**LXIII.**  
*Neotropical Species.* By CHARLES P. ALEXANDER,  
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Massachusetts, U.S.A.

THE novelties herewith considered are all from Peru and all belong to the large-sized crane-flies of the subfamily Tipulinæ. Almost all of the species were taken by Mr. Felix Woytkowski, in the Departments of Huanuco and Junin; a few other species were secured by Mr. Pedro Paprzycki in Junin and by Mr. Herbert S. Parish in the Amazonian Department of Loreto. I am indebted to these collectors for their continued interest in saving these fragile flies. All types are preserved in my extensive series of these flies.

*Ozodicera (Dihexaclonus) spilophæa*, sp. n.

Allied to *triguttata*; general coloration obscure yellow, the præscutum with four poorly indicated darker stripes; basal segments of antennal flagellum brownish yellow, the branches unequal; femora and tibiæ brownish yellow, their tips narrowly infuscated; wings relatively broad, intense brownish yellow, with darker brown areas on anterior cord and on basal section of  $M_3$ ; abdominal tergites brownish yellow, the lateral borders conspicuously dark brown; male hypopygium with the tergal lobes unusually long and narrow, the tips subacute; basistyle not produced at apex; phallosome consisting of a pair of identical rods that are dilated at their outer ends, the gonapophyses shorter, straight.

*Male*.—Length about 25 mm.; wing 19 mm.; antenna about 6.5 mm.

*Female*.—Length about 27–30 mm.; wing 19–21 mm.

Frontal prolongation of head elongate, brownish yellow; nasus short and stout; palpi black. Antennæ with the scape brown, pedicel and the branches of flagellar segments brownish yellow; simple terminal segments black; flagellar branches unequal, one being only about one-half the length of the other and arising from its base, the shorter branch of the outer segment even more reduced; in female the branches are even longer and more conspicuous than in male. Head light brown.

Mesonotum with ground-colour obscure yellow or brownish yellow, the præscutum with four poorly indicated darker brown stripes, the intermediate pair reddish brown, the lateral ones a little darker, slightly pruinose; scutal lobes similarly variegated with brown pruinose areas; scutellum and postnotum pale brown with a whitish sericeous pollinosity. Pleura pale with a yellowish bloom. Halteres brown, the knobs a trifle darker. Legs with the coxæ pale, yellowish-grey pollinose; trochanters yellow; femora and tibiæ brownish yellow, the tips narrowly and weakly infuscated; tarsi passing into black. Wings broader than in *triguttata*; ground-colour intense brownish yellow, the prearcular and costal fields even more saturated; stigma scarcely darker than the ground; two darker brown areas, the larger one on anterior cord, the second on basal section of  $M_3$  and adjoining portion of *m-cu*; veins deep yellow, darker in the infuscated areas. Venation: cell  $M_1$  broadly sessile.

Abdominal tergites brownish yellow, the lateral borders conspicuously dark brown; sternites yellow; hypopygium brownish yellow. Male hypopygium (fig. 3) with the tergal lobes, 9 *l*, unusually long and slender, narrowed to the subacute tips, the notch separating them deep U-shaped; lobes with abundant setæ, the apices with additional dense dark setulæ. Basistyle, *b*, not produced at apex, the dististyles terminal in position. Outer dististyle, *od*, short and broad, dilated before mid-length, the greatest width about two-thirds the length. Inner dististyle a simple curved sclerotized rod, the distal half narrowed into a long beak, the outer face of basal half with numerous coarse erect setæ; before apex of beak with a roughened triangle flange. Phallosome, *p*, consisting of two longer paired elements that are dilated at distal ends, subtended on either side by shorter, weakly clavate, straight rods.

*Hab.* Peru (Junin, Huanuco).

*Holotype*, ♂, Pumahuasi, Huanuco, altitude 980 metres, August 27, 1939 (*Woytkowski*). *Allotopotype*, ♀, July 21, 1939. *Paratopotypes*, 2 ♀♀, July 9–23, 1939 (*Woytkowski*); *paratype*, 1 ♀, Satipo, Jauja, Junin, altitude 800–900 metres, January 3, 1940 (*Paprzycki*).

*Ozodicera (Dihexaclonus) spilophæa* is most similar to *O. (D.) triguttata* Alexander, of Amazonian Brazil, which

is well distinguished by the narrow wings and by the very different male hypopygium, especially the broad tergal lobes, the long apical arms of the basistyle, and the very different inner dististyle.

*Ozodicera (Ozodicera) phallacantha*, sp. n.

General coloration buffy grey, the præscutum with four more reddish-brown stripes that are more or less distinctly bordered by darker; antennal flagellum, with branches, black; wings with a strong brownish tinge; abdominal tergites weakly trivittate with darker brown; subterminal segments brownish grey, forming a subterminal ring; male hypopygium with the tergite very shallowly notched; inner dististyle complex, bearing five spines or sclerotized points; phallosome produced into four spines, the outer pair longer and straighter.

*Male*.—Length about 21–22 mm.; wing 18–19 mm.; antenna about 5.5–6 mm.

*Female*.—Length about 29–30 mm.; wing 21–22 mm.

Frontal prolongation of head brown; nasus stout; palpi black. Antennæ with scape, pedicel and narrow base of first flagellar segment obscure yellow, the remainder, including the flagellar branches, black; branches shorter than the segments. Head brownish grey; anterior vertex narrower than the diameter of scape.

Mesonotal præscutum buffy grey, the præscutum with four more reddish-brown stripes that are feebly indicated against the ground, in cases with these stripes narrowly bordered by darker brown; præscutal interspaces with small dark setigerous punctures; posterior sclerites of notum light brown, the scutal lobes slightly darkened. Pleura obscure yellow, the ventral sternopleurite weakly darkened. Halteres infuscated. Legs with the coxæ and trochanters yellow; femora brown, the tips weakly more darkened; tibiæ dark brown, the tips narrowly black; tarsi black. Wings with a strong brown tinge, the stigma feebly darkened; prearcular and costal fields a trifle more saturated; veins brown. One paratype has the ground-colour of most of the wing paling to grey, leaving brown areas in the bases of cells *R* to *Cu* and again near the stigma and anterior cord, producing a weakly-patterned appearance. Venation: cell *M*<sub>1</sub> broadly sessile.

Abdomen reddish brown, the tergites weakly trivittate with slightly darker brown, including a narrow median stripe that is broken at the posterior border of each segment and continuous lateral stripes on the more basal segments; male with segments seven and eight brownish grey to form a narrow dark subterminal ring; sternites clearer brownish yellow. Male hypopygium (fig. 4) with the caudal margin of tergite, 9 *t*, transverse, with a very shallow median emargination, the lateral lobes thus formed very low and wide. Basistyle, *b*, not produced into a lobe or spine. Inner dististyle, *id*, a complex sclerotized structure bearing five outer spines and points, as shown. Phallosome, *p*, of unique structure in the genus as known; four-spined, including longer straight outer spines directed laterad and caudad, and inner short gently curved spines directed caudad.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Leonpampa, altitude 980 metres, December 30, 1937 (*Woytkowski*). *Allotype*, ♀, Pumahuasi, altitude 980 metres, August 15, 1939 (*Woytkowski*). *Paratypes*, 2 ♂♂, 1 ♀, with allotype, July 20–August 30, 1939 (*Woytkowski*).

The present fly is closest to *Ozodicera* (*Ozodicera*) *multiermis* Alexander and *O. (O.) trispinifer* Alexander, both of Ecuador, differing conspicuously in the structure of the male hypopygium, notably of the inner dististyle and the phallosome.

*Tanypremna* (*Tanypremnella*) *perdistincta*, sp. n.

General coloration of mesonotum dark brown; pleura yellow, the mesepisternum darkened to form a transverse girdle; halteres with stem yellow, knob dark brown; legs with femora obscure yellow, the tips narrowly blackened; tibiæ and tarsi white; wings whitish subhyaline, the stigmal area blackened, very large, occupying the area between  $R_s$  and  $R_2$ ;  $R_s$  very short, oblique, shorter than the basal section of  $R_{4+5}$ ; cell 1st  $M_2$  large, irregularly hexagonal, the three longest elements being both sections of  $M_{1+2}$  and the basal section of  $M_3$ ; cell 2nd  $A$  very short and narrow; abdomen orange-yellow, the caudal borders of the segments blackened; hypopygium black; male hypopygium with the beak of the inner dististyle long and slender.

*Male*.—Length about 7–7.5 mm.; wing 8.6–9 mm.

Frontal prolongation of head yellow; palpi broken. Antennæ with scape and pedicel light yellow; flagellum broken. Head yellow; anterior vertex relatively wide, approximately twice the diameter of scape.

Pronotum obscure yellow. Mesonotum chiefly uniform dark brown, the præscutal stripes confluent or virtually so; median area of scutum scarcely brightened; parascutella, lateral margins of mediotergite and the pleruotergite yellow. Pleura yellow with a conspicuous dark brown

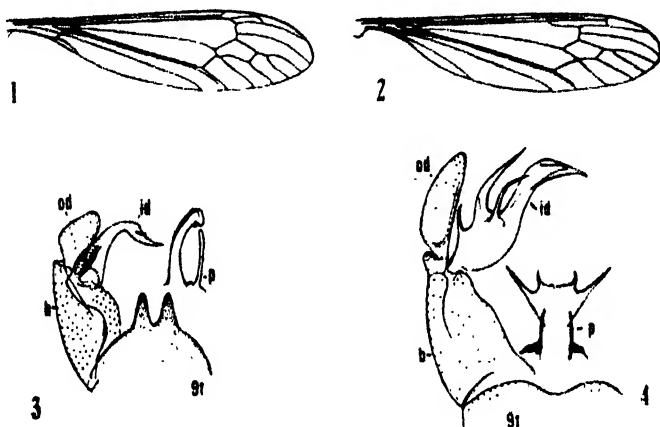


Fig. 1.—*Tanypremna* (*Tanypremnella*) *perdistincta*, sp. n.; venation.

Fig. 2.—*Tanypremna* (*Tanypremnella*) *antennifera*, sp. n.; venation.

Fig. 3.—*Ozodicera* (*Dihexaclonus*) *epilophaea*, sp. n.; male hypopygium.

Fig. 4.—*Ozodicera* (*Ozodicera*) *phallacantha*, sp. n.; male hypopygium.

(Symbols: b, basistyle; id, inner dististyle; od, outer dististyle; p, phallosome; t, tergite.)

girdle on mesepisternum. Halteres elongate, stem yellow, knob dark brown. Legs with the coxæ and trochanters yellow; femora obscure yellow, the tips rather narrowly but conspicuously blackened, the amount subequal on all legs; tibiæ white, the tips very narrowly darkened; tarsi white. Wings (fig. 1) whitish subhyaline, the blackened stigmal area very large and conspicuous, filling the space between  $R_s$  and  $R_2$ , with a very restricted dark cloud on basal section of  $R_{4+5}$ ; veins brownish black. Venation:  $R_s$  very short, oblique, straight,

shorter than the basal section of  $R_{4+5}$ ; cell 1st  $M_2$  large, irregularly hexagonal, the basal section of  $M_{1+2}$  long, subequal to the second section; basal section of  $M_3$  even longer, weakly sinuous; petiole of cell  $M_1$  and  $m$  subequal;  $Cu_2$  relatively distant from  $Cu_1$ , not reaching the posterior margin; cell 2nd  $A$  very short and narrow.

Abdomen orange-yellow, the caudal borders of the segments conspicuously black, broadest on tergites one to four, narrower on five to eight, inclusive; sternites similarly patterned, the darkenings of the subterminal segments less conspicuous; hypopygium black. Male hypopygium with the caudal border of tergite broadly rounded, with a small, shallow, median notch. Inner dististyle with the beak long and slender, the outer lobe with long coarse setæ and abundant shorter setulæ.

*Hab.* Peru (Junin).

*Holotype*. ♂, Satipo, Jauja, altitude 800–900 metres, September 24, 1939 (*Paprzycki*). *Paratopotype*, 1 ♂, with type.

*Tanypremna* (*Tanypremnella*) *perdistincta* is very different from all other members of the subgenus so far described. It is well distinguished from *T. (T.) crystallina* Alexander and allies by the entirely different wing venation and by the structure of the male hypopygium, notably the long narrow beak of the inner dististyle.

*Tanypremna (Tanypremnella) antennifera*, sp. n.

General coloration of mesonotum medium brown, unpatterned; antennæ (male) subequal in length to the entire body or wing, the flagellar segments elongate-cylindrical, with long, erect verticils; legs with tips of tibiæ broadly white; tarsi white, the basitarsi dusky on proximal half; wings whitish hyaline, cell  $Sc$  and the small stigma dark brown;  $R_3$  longer than  $R_{2+3}$ ;  $r-m$  subequal to the basal section of  $R_{4+5}$ ; petiole of cell  $M_1$  shorter than  $m$ ; male hypopygium with the beak of inner dististyle stout and obtuse, but conspicuous.

*Male*.—Length about 10 mm.; wing 10.8 mm.; antenna 10.5 mm.

Frontal prolongation of head yellow, the outer end slightly darkened; palpi black. Antennæ (male) elongate, subequal in length to either the wing or body; scape, pedicel and base of first flagellar segment yellow, the



remainder of organ-black; flagellar segments long-cylindrical, clothed with long erect verticils that are considerably longer than in *transfasciata*. Head fulvous-brown, the anterior vertex relatively narrow, subequal in width to the diameter of scape.

Pronotum and mesonotum medium brown, unmarked or virtually so. Pleura yellow, the mesepisternum dark brown to form a conspicuous transverse girdle. Halteres elongate, dark brown. Legs with the coxæ and trochanters yellow; femora brownish black, the bases yellow; tibiæ black, the tips conspicuously white, involving about the distal fifth; tarsi white, the basitarsi more dusky on proximal half. Wings (fig. 2) whitish hyaline; cell *Sc* and the small stigma dark brown; extreme tip of wing in radial field darkened; veins dark brown. Venation: *Rs* longer than in *transfasciata*, exceeding  $R_{2+3}$ ;  $r-m$  conspicuous, subequal to the basal section of  $R_{4+5}$ ; petiole of cell  $M_1$  shorter than  $m$ ; cell 2nd *A* slightly wider than in *transfasciata*.

Abdomen obscure yellow or brownish yellow, the caudal borders of the segments dark brown, more extensive on outer segments; sternites yellow: a narrow, dark brown ring involving segments eight and nine; remainder of hypopygium paling to yellow. Male hypopygium with the tergite large, the caudal margin evenly rounded, without lateral angles. Inner dististyle gradually narrowed into an obtuse lobe or beak; outer margin of style near base with about 10 to 12 small blackened spines. Gonapophyses with blades wider and shorter than in *transfasciata*.

*Hab.* Peru (Junin).

*Holotype*, ♂, Satipo, Jauja, altitude 800-900 metres, February 22, 1940 (*Paprzycki*).

*Tanypremna* (*Tanypremnella*) *antennifera* is readily told from the most similar described species, *T. (T.) transfasciata* Alexander, of Ecuador, by the even longer antennæ of the male and with further distinctions in coloration and venation.

*Tipula* (*Nephrotomodes*) *myriatricha*, sp. n.

General coloration of thorax fulvous-yellow, without pattern; antennæ (male) elongate, exceeding one-half the length of wing; wings with numerous macrotrichia in outer radial and medial cells; male hypopygium with

the caudal border of ninth tergite convexly rounded, the ventral surface before apex with a group of blackened spinous setæ on either side of the median line.

*Male*.—Length about 13 mm. ; wing 14 mm. ; antenna about 7.5 mm.

Frontal prolongation of head relatively short and stout, subequal to remainder of head, medium brown ; nasus elongate ; palpi long, especially the terminal segment ;

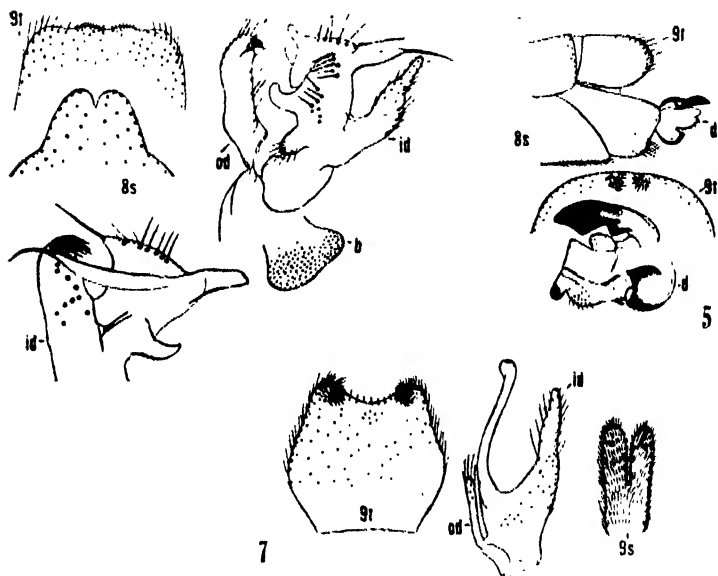


Fig. 5.—*Tipula* (*Nephrotomodes*) *myriatricha*, sp. n. ; male hypopygium.

Fig. 6.—*Tipula* (*Nephrotomodes*) *languidula*, sp. n. ; male hypopygium.

Fig. 7.—*Tipula* (*Nephrotomodes*) *didactyla*, sp. n. ; male hypopygium.

(Symbols : b, basistyle ; d, dististyle ; id, inner dististyle ; od, outer dististyle ; s, sternite ; t, tergite.)

basal segments dark brown, the terminal one paler brown. Antennæ with basal three segments yellow, the remaining ones black, the basal two with incisures restrictedly brightened ; antennæ exceeding one-half the length of wing ; flagellar segments elongate, with small oval basal swellings ; verticils shorter than the segments ; terminal segment small, about equal in length to the basal enlarge-

ment of the preceding one. Head dark cinnamon-brown ; no distinct vertical tubercle.

Mesonotum almost uniform fulvous-yellow without distinct markings. Pleura more yellow ; a faintly indicated darkened area around wing-base, continued caudad to abdomen along the posterior border of pleurotergite. Halteres with stem brownish yellow, knob more darkened. Legs with coxæ and trochanters light yellow ; remainder of legs yellowish brown to pale brown, the tarsi somewhat darker ; legs long and slender ; claws with a single strong spine before mid-length. Wings with a brownish tinge, the prearcular region, costal cell and stigma darker brown ; cell *Sc* more yellowish brown ; a conspicuous white obliterative area before stigma, with fainter such areas across cell 1st  $M_2$  ; veins brown. Numerous macrotrichia in outer halves of cells  $R_3$ ,  $R_5$ , and  $M_1$ , with fewer ones in 2nd  $M_2$  and  $M_3$ . Venation :  $R_s$  moderately long, exceeding *m-cu* ; tip of  $R_{1+2}$  abruptly atrophied ; petiole of cell  $M_1$  long, subequal to cell ; cell 1st  $M_2$  small ;  $M_{3+4}$  only a little more than one-half the basal section of  $M_{1+2}$  ; cell 2nd *A* moderately wide.

Abdominal tergites obscure yellow, the lateral borders brown, the latter colour becoming more extensive and conspicuous on the outer segments, restricting the central ground-pattern ; basal sternites yellow ; subterminal segments blackened ; hypopygium obscure yellow. Male hypopygium (fig. 5) small and simple ; tergite, 9*t*, entirely separated from the sternite ; eighth sternite, 8*s*, moderately sheathing, the caudal margin convexly rounded, very slightly notched medially. Ninth tergite, 9*t*, with the caudal margin convexly rounded, provided with long coarse yellow setæ ; on ventral surface just back from border with a group of short black spinous setæ on either side of median line. Dististyle, *d*, complex, as figured. Margin of basistyle ventrad of point of insertion of dististyle with a few very long, powerful setæ ; mesal face with a flattened plate as is common in members of this subgenus, the surface squamulose.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Piedras Grandes, altitude 3000 metres, November 14, 1937 (*Woytkowski*).

*Tipula* (*Nephrotomodes*) *myriatricha* is readily told from all other described Neotropical species of the genus, with

the exception of *T. (N.) languidula*, sp. n., by the abundant macrotrichia in the outer cells of the wing. Despite this character there is no question but that the two species should be referred to the subgenus *Nephrotomodes* Alexander, vastly developed in Tropical America.

*Tipula (Nephrotomodes) languidula*, sp. n.

General coloration of notum uniform orange-fulvous, without distinct præscutal stripes; antennæ of moderate length, the more basal flagellar segments weakly bicoloured; legs yellow, the terminal tarsal segments passing into brown; wings brownish yellow, the prearcular field, cell *C'* and the stigma darker brown; relatively numerous macrotrichia in outer ends of cells  $R_3$  to 2nd  $M_2$ , inclusive;  $R_{1+2}$  entire; male hypopygium with caudal margin of tergite nearly transverse; dististyles complex.

*Male*.—Length about 12 mm.; wing 13 mm.; antenna about 4.9 mm.

Frontal prolongation of head of moderate length only, uniform-obscure yellow; unusually deep, sloping gradually into the vertex without a well-marked notch; nasus short and stout; palpi yellow throughout. Antennæ of moderate length; basal three segments yellow; succeeding segments very weakly bicoloured, brown, the basal enlargements very slightly darker; flagellar segments elongate, gently incised; verticils shorter than the segments. Head uniform orange-fulvous, without evident vertical tubercle.

Pronotum and mesonotum uniform orange-fulvous, the præscutal stripes not or scarcely differentiated against the ground; præscutum glabrous, the lateral portions of scutal lobes with long erect setæ. Pleura uniform pale yellow. Halteres elongate, stem yellow, knob weakly infuscated. Legs with coxæ and trochanters yellow; remainder of legs yellow, the tarsal segments passing into brown; claws (male) toothed; legs very long and slender. Wings with a brownish yellow tinge, the prearcular field, cell *C* and the stigma darker brown; cell *Sc* deeper yellow; veins brown, *Cu* more yellow on basal portion. Relatively numerous macrotrichia in outer ends of cells  $R_3$  to 2nd  $M_2$ , inclusive. Venation:  $R_{1+2}$  entire; petiole of cell  $M_1$  about twice *m*.

Abdominal tergites obscure yellow, the lateral portions and the outer segments more infuscated; a subterminal dark brown ring including segments six to eight; sternites and hypopygium yellow. Male hypopygium (fig. 6) with the caudal margin of tergite. 9 *t*, nearly transverse, on either side of the mid-line with a very low lobe provided with coarse black setæ. Lobe of mesal face of basistyle, *b*, pale, not heavily blackened as in many species of the subgenus. Dististyles complex, as shown; outer style, *od*, blackened and more or less spinous at apex. Eighth sternite, 8 *s*, relatively long, at apex produced into a bilobed median structure that bears a few elongate bristles and abundant close-set shorter setæ.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Piedras Grandes, altitude 3000 metres, November 30, 1937 (Woytkowski).

The only near ally of the present fly is *Tipula* (*Nephrotomodes*) *myriatricha*, sp. n., likewise from Piedras Grandes, readily told from this species by the elongate antennæ, distinctive wing-pattern and the very different male hypopygium.

*Tipula* (*Nephrotomodes*) *didactyla*, sp. n.

General coloration dark plumbeous or leaden, the postnotum and pleura clearer grey; antennal flagellum black; halteres brownish black; legs black, the femoral bases restrictedly yellow; wings dusky, prearcular field and cell *C* pale brown, cell *Sc* and stigma darker brown; cell 2nd *A* very narrow; abdominal tergites black, the lateral borders obscure yellow; male hypopygium with the ninth tergite bilobed; inner dististyle profoundly bifid; appendage of ninth sternite bilobed.

*Male*.—Length about 12 mm.; wing 11 mm.; antenna about 5 mm.

*Female*.—Length about 15–16 mm.; wing 12–14 mm.; antenna about 2.4–2.6 mm.

Frontal prolongation of head dark brown above, obscure brownish yellow on sides and beneath; nasus very short and stout. Antennæ (male) elongate; scape and pedicel dark brown, flagellum uniformly black; flagellar segments moderately incised; verticils much shorter than the segments. Head dark brown, the front and very narrow orbits light grey; vertical tubercle lacking.

Pronotum dark grey. Mesonotal præscutum, scutum and scutellum uniform dark plumbeous or leaden, without markings, the postnotum lighter grey pruinose; vestiture of præscutal interspaces very short and sparse. Pleura and pleurotergite grey; dorsopleural membrane weakly darkened. Halteres brownish black. Legs with the coxæ pale, sparsely pruinose, the fore pair more heavily so; trochanters obscure yellow; remainder of legs black, the extreme femoral bases obscure yellow; claws toothed. Wings with a dusky tinge; prearcular field and cell *C* pale brown; cell *Sc* and stigma darker brown; outer radial field more weakly darkened; veins brownish black. Venation:  $R_{1+2}$  entire or (type male) with distal end atrophied in one wing only; cell 2nd *A* very narrow, a trifle wider in the female.

Abdominal tergites black, the lateral borders on basal half or more of segments obscure yellow; basal sternites yellow; a narrow black subterminal ring; hypopygium obscure yellow. In female the tergites more uniformly blackened; sternites yellow. Ovipositor black; cerci straight, the tips obtuse and slightly bulbous; outer faces of cerci only slightly hairy. Male hypopygium (fig. 7) with the tergite, 9*t*, elongate, widest before mid-length; caudal margin with a broad U-shaped emargination, the low lateral lobes with numerous black setæ arranged in a close group, the setæ directed chiefly mesad. Basistyle with lobe on mesal face relatively small, heavily blackened. Outer dististyle, *od*, a very small, long-cylindrical lobe with about seven or eight elongate setæ, all on distal half. Inner dististyle, *id*, much larger, profoundly bifid, the longest arm more slender and nearly glabrous, at apex expanded into an obtuse flattened disk; shorter arm gradually narrowed to the obtuse tip, the surface, especially the outer margin, with abundant long coarse setæ. Appendage of ninth sternite, 9*s*, bilobed, each lobe relatively narrow, clothed with numerous setæ. Eighth sternite with posterior margin broadly convexly rounded, the median portion with long scattered setæ.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Pumahuasi, altitude 980 metres, August 27, 1939 (*Woytkowski*). *Allotopotype*, ♀, with type. *Paratype*, 1 ♀, Leonpampa, in jungle, altitude 800 metres, December 26, 1937 (*Woytkowski*).

*Tipula* (*Nephrotomodes*) *didactyla* is closest to species such as *T. (N.) detecta* Alexander, of Venezuela; *T. (N.) effeta* Alexander, of Amazonian Peru; and *T. (N.) ortonii* Alexander, of Amazonian Bolivia. It differs in the coloration of the body, wings and legs, the details of venation, and in the structure of the male hypopygium. The male sex of *detecta* is still unknown.

*Tipula* (*Nephrotomodes*) *lyriformis*, sp. n.

General coloration of mesonotum brownish yellow to pale brown; the pleura yellow; antennæ elongate, flagellum black; wings with a brownish tinge, cells *C* and *Sc*, with the stigma, darker brown; cell 2nd *A* narrow; abdominal tergites brown, the subterminal segments darker; male hypopygium with the caudal margin of tergite trilobed, the apex of the median lobe truncate, provided with abundant blackened points; appendage of ninth sternite conspicuously lyriform.

*Male*.—Length about 12 mm.; wing 12 mm.; antenna about 5.2 mm.

*Female*.—Length about 13 mm.; wing 12.5 mm.

Frontal prolongation of head obscure yellow, relatively short; basal segment of palpus darkened at mid-length, the remainder of organ pale yellow. Antennæ (male) moderately elongate, as shown by the measurements; scape and pedicel yellow; first flagellar segment blackened, vaguely paler at both ends; remainder of flagellum black; flagellar segments very weakly incised, with short verticils. Head brown, the front and narrow orbits pale.

Mesonotum almost uniform brownish yellow to pale brown, the præscutal stripes not or scarcely differentiated. Pleura obscure yellow. Halteres blackened. Legs with coxæ and trochanters obscure yellow; femora obscure yellow to brownish yellow; tibiæ and tarsi dark brown. Wings with a brownish tinge, cells *C* and *Sc*, with the oval stigma, darker brown; a scarcely indicated dark seam on anterior cord; veins brown. Venation: *Rs* a little longer than *m-cu*; petiole of cell *M*<sub>1</sub> a trifle longer than *m*; cell 2nd *A* narrow.

Abdominal tergites brown, the more proximal segments paler on their basal rings; subterminal segments darker; sternites and hypopygium yellow. Male hypopygium (fig. 8) with the caudal margin of tergite, 9*t*, trilobed, the

lateral pair of lobes longer, their tips obtusely rounded; median lobe truncate at apex and set with abundant blackened points. Basistyle unusually long and slender, with the usual blackened lobe near its base on mesal face. Dististyles *id*, *od*, as shown. Notch of ninth sternite 9s, with a conspicuous lyriform appendage, the long arms provided with coarse setæ.

*Hab.* Peru (Loreto).

*Holotype*, ♂, Iquitos. March 10, 1920 (*Parish*). *Allotype*, ♀, March, 1920.

*Tipula* (*Nephrotomodes*) *lyriformis* is well-distinguished from the other members of the subgenus by the structure of the male hypopygium, especially the lyriform appendage of the ninth sternite.

*Tipula* (*Nephrotomodes*) *decens*, sp. n.

General coloration of thorax almost uniform orange, the præscutal stripes not or scarcely differentiated from the ground; femora brown, the bases slightly more brightened; wings greyish, cells *C* and *Sc*, with the stigma, dark brown; abdomen reddish brown, with a narrow black subterminal ring; male hypopygium with the ninth tergite extensive, the caudal edge emarginate, with a small truncated median lobe; outer dististyle with a conspicuous blackened tooth before apex; appendage of ninth sternite profoundly bifid, each lobe broadly flattened, with the apex emarginate.

*Male*.—Length about 12 mm.; wing 12 mm.; antenna about 5.8 mm.

Frontal prolongation of head relatively short, a little less than the remainder of head, shiny yellow; nasus very short and broad; first segment of palpi yellow, succeeding segments brownish yellow, the elongate terminal segment paling to light yellow. Antennæ of moderate length, approximately one-half as long as wing; scape, pedicel, and base of first flagellar segment yellow, the remaining segments black; flagellar segments elongate, gently incised, longer than the verticils. Head orange, more pruinose on anterior vertex; no distinct vertical tubercle.

Pronotum buffy-yellow. Mesonotum almost uniform orange, the præscutal stripes not or scarcely differentiated from the ground; mesonotal vestiture sparse, reduced



to microscopic setæ; pleura a little more yellowish. Halteres with stem obscure yellow, knob dark brown. Legs with coxæ and trochanters yellow; femora brown, the bases slightly more brightened; tibiæ and tarsi brownish black; claws (male) with a single strong flattened spine. Wings greyish, the prearcular field yellowish brown; cells *C* and *Sc* with the stigma, dark brown; cord, especially the posterior end of *m-cu*, very

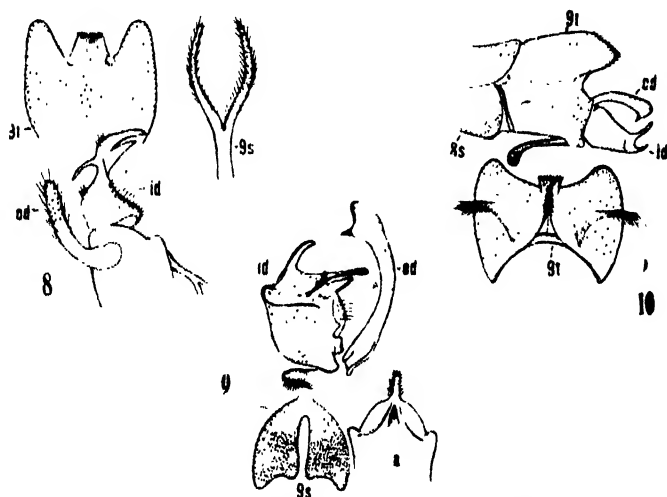


Fig. 8.—*Tipula (Nephrotomodes) lyriformis*, sp. n.; male hypopygium.

Figs. 9, 10.—*Tipula (Nephrotomodes) decens*, sp. n.; male hypopygium.

(Symbols: *a*, aedeagus; *id*, inner dististyle; *od*, outer dististyle; *s*, sternite; *t*, tergite.

narrowly and insensibly darkened; veins brown. Venation: *Sc* relatively short, *Sc*<sub>2</sub> ending about opposite one-fourth to one-fifth the length of *Rs*; *Rs* arcuated, subequal to *m-cu*; petiole of cell *M*<sub>1</sub> a little longer than *m*; cell 2nd *A* relatively wide.

Abdomen reddish brown, with a narrow, black sub-terminal ring that includes all of segment seven and the base of segment eight, the apex of the latter yellow; tergite six weakly darkened; eighth sternite dark brown with a large yellow area on either side of the posterior border; hypopygium yellow. Male hypopygium (figs. 9,

10) relatively simple in structure. Ninth tergite, 9t, extensive, the caudal margin emarginate, its median area with a small truncated lobe set with short black spinous setæ; lateral lobes of tergite obtuse, with long setæ, their tips curved; ventral surface of tergite with flattened lobes bearing long brushes of setæ, one arm directed laterad, the more extensive one mesad to cephalad. Outer dististyle, *od.* with a conspicuous blackened tooth before apex. Inner dististyle, *id.* complex, as shown, the rostrum very slender. Appendage of ninth sternite, 9s, profoundly bifid, each lobe broadly flattened, its apex emarginate, the surface densely set with short setæ. Ædeagus, *a.* at apex bearing numerous short spinous points.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Pumahuasi, altitude 980 metres, December 19, 1939 (*Woytkowski*).

In its wing-pattern, the present fly is most similar to *T. (N.) effulta* Alexander and *T. (N.) luctifica* Alexander, both of Ecuador, differing conspicuously in the structure of the male hypopygium.

*Tipula (Nephrotomodes) perdelecta*, sp. n.

General coloration polished yellow, variegated with polished stripes, the median præscutal stripe reddish with narrow black lateral borders; head uniformly polished yellow, without vertical tubercle; femora yellow, the tips narrowly blackened; wings with the prearcular and costal fields bright yellow, the outer radial field brown; stigma darker brown, provided with a few trichia; no macrotrichia on *M* or its branches; *Sc*<sub>2</sub> ending just beyond origin of *Rs*, *Sc*<sub>1</sub> lacking; *R*<sub>1+2</sub> entirely atrophied; abdomen yellow, the tergites trivittate with black, interconnected on caudal borders; ovipositor with fleshy cerci.

*Female*.—Length about 12 mm.; wing 11.5 mm.

Frontal prolongation of head light yellow, with coarse black setæ; nasus short and stout; palpi with basal three segments obscure yellow, the elongate terminal segment light brown. Antennæ 13-segmented; scape and pedicel yellow; flagellum black, the base and apex of first segment and apices of the succeeding six or seven segments restrictedly yellow to produce a weak bicoloured

appearance; flagellar segments with weakly-developed basal enlargements; verticils a little exceeding the segments; terminal segment small, about one-third the penultimate, but much more slender. Head uniformly polished yellow, without vertical tubercle; anterior vertex wide, fully four times the diameter of scape; sides of vertex with several black setæ.

Pronotum light yellow. Mesonotal præscutum yellow, with three more polished stripes, the median one reddish on the central portion with narrow but conspicuous black lateral borders to produce intermediate black stripes; lateral stripes black, conspicuous, crossing the suture onto the scutal lobes; posterior sclerites of notum yellow, the scutellum a very little darker; caudal border of mediotergite weakly darkened. Pleura and pleurotergite light yellow, variegated with more reddish areas on anepisternum and ventral sternopleurite. Halteres yellow, the base of knob weakly darkened. Legs with coxæ and trochanters yellow; femora yellow, the tips rather narrowly but conspicuously brownish black, the amount subequal on all legs; tibiæ obscure yellow, the tips narrowly and weakly darkened; tarsi black, the proximal ends of basitarsi paler. Wings conspicuously patterned; ground-colour pale yellow, with the prearcular field, cells *C* and *Sc*, and the linear cell *Cu*<sub>1</sub> intense yellow; wing-tip in outer radial field infuscated; stigma darker brown, with about eight strong setæ in cell *R*<sub>1</sub>; veins brown, in the flavous area paling to yellow. No macrotrichia on *M* or its branches. Venation: *Sc*<sub>2</sub> entering *R*<sub>1</sub> just beyond origin of *Rs*, *Sc*<sub>1</sub> lacking; *Rs* arcuated; *R*<sub>1+2</sub> entirely atrophied; *r-m* reduced; cell 1st *M*<sub>2</sub> moderately long; petiole of cell *M*<sub>1</sub> nearly twice the length of *m*; *m-cu* at near one-third the length of cell 1st *M*<sub>2</sub>; cell 2nd *A* of moderate width.

Abdomen yellow, the tergites trivittate with black, beyond the first segment forming continuous stripes that are more or less interconnected by dark posterior borders, these latter narrow to lacking on tergites four and five; on tergite six the central black area widely expanded; segment eight uniformly black; genital segment and ovipositor orange; sternites orange-yellow. Ovipositor with cerci somewhat fleshy, finger-like in outline, with long black setæ throughout their length.

*Hab.* Peru (Huanuca).

*Holotype*, ♀, Pumahuasi, altitude 980 metres, July 19, 1939 (*Woytkowski*).

*Tipula* (*Nephrotomodes*) *perdelecta* is entirely different from other Neotropical species. In its *Nephrotoma*-like coloration it somewhat resembles the otherwise entirely distinct *Tipula flavopolita* Alexander, of south-eastern Brazil. The wing coloration of the present fly is unusually beautiful.

*Tipula novatrix*, sp. n.

Belongs to the *glaphyroptera* group; allied to *notoria*; mesonotal præscutum grey, with three conspicuous dark brown stripes, the median one vaguely divided by a central paling; halteres elongate, pale yellow throughout; femora pale brown, with a black subterminal ring that is preceded and followed by yellow annuli, the apical one narrow; wings conspicuously and handsomely patterned with whitish subhyaline, yellow, pale brown and dark brown; cells beyond cord conspicuously variegated with white, including a complete cross-band that further involves most of cell  $R_5$ ; vein  $R_{1+2}$  entirely atrophied.

*Female*.—Length about 11 mm.; wing 13.8 mm.

Frontal prolongation of head dark brown; nasus distinct; palpi brownish black, relatively short. Antennæ with basal three segments yellow; succeeding segments weakly bicoloured, the bases slightly darker than the outer portions; outer six or seven segments uniform brownish black; basal swellings of segments not developed; verticils shorter than the segments. Head buffy yellow on the vertical tubercle, more greyish behind and on the orbits, the posterior vertex infuscated; a capillary median brown vitta extending from the vertical tubercle backwards.

Pronotum brownish grey. Mesonotal præscutum grey, with three conspicuous dark brown stripes, the median one vaguely divided by a central paling; scutum with lobes conspicuously dark brown; scutellum paler brown, sparsely pruinose; parascutella and postnotum dark brown, heavily pruinose. Pleura grey, variegated with darker brownish grey on ventral anepisternum, ventral sternopleurite and on meron. Halteres elongate, pale yellow throughout. Legs with the coxæ light grey; trochanters obscure yellow; femora pale brown, the

extreme bases clearer yellow ; a conspicuous black sub-terminal ring, preceded and followed by yellow, the apical yellow ring only about one-half as extensive as the sub-terminal one ; tibiae pale brown, the tips darker brown ; tarsi brownish black. Wings much as in *notoria*, but the cells beyond cord conspicuously variegated with white ; ground-colour whitish subhyaline, conspicuously patterned with bright yellow, pale brown and darker brown ; cell *C* uniformly pale brown except for a darkening at *h* ; cell *Sc* bright yellow, with four brown areas that are smaller than the ground interspaces ; a conspicuous yellow area at and before arculus ; the chief white areas include a complete cross-band beyond cord, involving almost all of cells  $R_6$  and 1st  $M_2$  ; further pale areas beyond cord, including outer end of cell  $R_3$ , most of  $M_1$ , base and apex of 2nd  $M_2$ , and the extreme tip of  $M_4$  ; basad of cord the white is very extensive, arranged much as in *notoria*. Venation :  $R_{1+2}$  entirely atrophied ; cell 1st  $M_2$  relatively large ; *m-cu* long, at fork of  $M_{3+4}$  ; cell 2nd *A* moderately wide.

Abdominal tergites chiefly light brown, discoloured by egg masses inside the body ; sternites similar, the extreme posterior margins of segments buffy grey ; genital segment dark ; cerci long and straight, horn-yellow.

*Hab.* Peru (Huanuco).

*Holotype*, ♀, Piedras Grandes, altitude 3000 metres, November 28, 1937 (*Woytkowski*).

*Tipula novatrix* is close to *T. notoria* Alexander, of Ecuador, differing especially in the coloration, notably of the wings, where the white beyond the cord forms a conspicuous and complete cross-band. Other apparently less closely-allied species include *T. consonata* Alexander and *T. fraudulenta* Alexander, both of Ecuador.

*Tipula trispilota*, sp. n.

Belongs to the *monilifera* group ; size very large (wing, male, over 20 mm. ; antenna 17 mm.) ; general coloration of mesonotum light brown, the præscutum with four grey stripes ; femora obscure yellow with a nearly terminal black ring ; wings reddish brown, conspicuously variegated by darker brown, yellow and whitish subhyaline ; cell *Sc* yellow with three conspicuous dark brown areas ; a whitish obliterative area across base of cell 1st  $M_2$  ;

male hypopygium with the median tergal notch very narrow, the adjoining angles not produced; lobe of eighth sternite relatively stout, its length about three times the breadth at base.

*Male*.—Length about 19 mm.; wing 20.5 mm.; antenna about 17 mm.

Frontal prolongation of head long, subequal to remainder of head; brown, darker on sides; nasus distinct; palpi brown, the terminal segment brownish black. Antennæ (male) very long, exceeding three-fourths the length of wing; basal three segments yellow, succeeding segments strongly bicoloured, the globular basal enlargement brownish black, the stem obscure brownish yellow; longest verticils only a little shorter than the segments; besides the powerful basal verticils the entire segment is clothed with long erect setæ. Head light yellow pollinose, variegated with brownish spots.

Mesonotal præscutum light brown with four grey stripes, the intermediate pair separated by a capillary dark brown median vitta; lateral stripes more or less distinctly bordered by a yellow line, especially distinct along outer face; setigerous punctures inconspicuous; scutal lobes light grey, with dark grey areas; scutellum brown, more or less distinctly yellowish brown pollinose; mediotergite yellowish grey with a dark median vitta. Pleura grey, slightly variegated by darker grey areas, especially on ventral portions; ventral pleurotergite paler. Halteres elongate, stem yellow, knob darkened. Legs with coxæ grey; trochanters yellow; femora obscure yellow, with a nearly terminal black ring, subequal in extent on all legs; tibiæ reddish brown, the tips narrowly blackened; tarsi reddish brown, the outer segments dark brown. Wings reddish brown, conspicuously patterned with darker brown, yellowish and whitish subhyaline; cell *C* uniformly brown; cell *Sc* yellow, with three conspicuous dark brown areas, the second at origin of *Rs*; stigma scarcely darker than the costal cell; the whitish areas include very restricted markings before and beyond stigma; a conspicuous oblitative area across basal half of cell 1st *M*<sub>2</sub>; conspicuous areas in cell 1st *A*, including an elongate U-shaped mark at near mid-length of cell; more yellowish areas include restricted markings in outer medial field and

tip of cell  $R_5$ , and as relatively extensive and conspicuous patterns in cells  $R$  and  $M$ ; cell 2nd  $A$  uniformly of the ground-colour. Venation:  $R_{1+2}$  pale, but entire;  $Rs$  a little less than twice  $m-cu$ ;  $m-cu$  on  $M_4$  shortly beyond the perpendicular base; cell 2nd  $A$  wide.

Abdomen with basal tergites yellowish brown; succeeding two tergites yellow on basal ring, infuscated

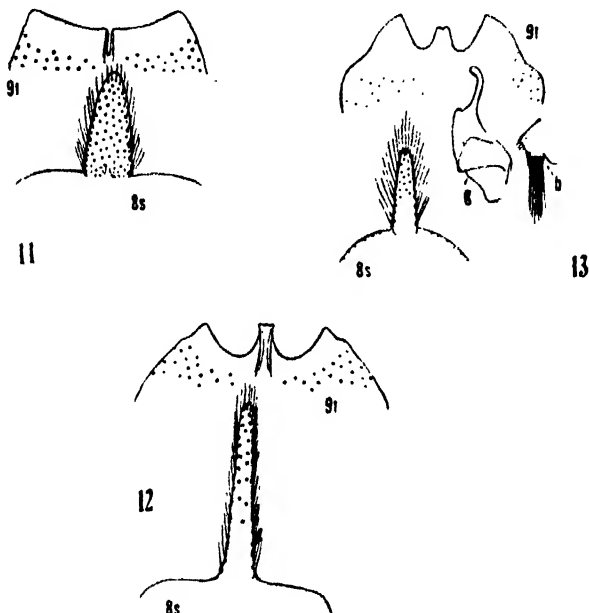


Fig. 11.—*Tipula triaspilota*, sp. n.; male hypopygium.

Fig. 12.—*Tipula stenoglossa*, sp. n.; male hypopygium.

Fig. 13.—*Tipula woytkowskiana*, sp. n.; male hypopygium.

(Symbols:  $b$ , basistyle;  $\mu$ , gonapophysis;  
 $a$ , sternite;  $t$ , tergite.)

laterally and on the broad posterior portions; outer segments more uniformly dark brown; lateral borders of basal tergites pale; outer portions of hypopygium chiefly obscure yellow. Male hypopygium (fig. 11) with the caudal margin of tergite  $9t$ , evenly and gently emarginate, the median portion with a very narrow slit-like notch, the adjacent angles scarcely produced, obtuse; entire

posterior margin of tergite without major setæ. Basistyle entire, with a group of long setæ on ventral portion; ventromesal lobe small, tufted with long setæ. Outer dististyle moderately broad, with long black setæ. Inner dististyle terminating in a relatively stout head; outer margin with long, but delicate scattered setæ. Lobe of eighth sternite, 8s, relatively stout, reddish yellow in colour; length about three times the breadth at base, the setæ long and coarse, reddish brown.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Piedras Grandes, altitude 3000 metres, November 21, 1937 (*Woytkowski*).

*Tipula trispilota* is the largest and finest species of the *monilifera* group so far discovered. In addition to the great size and unusual length of the antennæ, the fly is well distinguished by the wing-pattern, as the variegated cell Sc, and by the structure of the male hypopygium.

*Tipula stenoglossa*, sp. n.

Belongs to the *monilifera* group; antennæ of moderate length, exceeding one-half the length of wing; mesonotal præscutum reddish brown with four darker stripes; dark setigerous punctures conspicuous; wings strongly infuscated, sparsely patterned with darker brown and cream-coloured areas; cells C and Sc uniformly darker brown; abdominal tergites yellow, conspicuously trivittate with black; male hypopygium with posterior border of tergite conspicuously emarginate and bearing a long median lobe to form two oval sublateral notches; lobe of eighth sternite unusually long and narrow.

*Male*.—Length about 15 mm.; wing 16 mm.; antenna about 9.5 mm.

Frontal prolongation of head brownish yellow, a little clearer yellow above, elongate, slightly exceeding the remainder of head; nasus long and conspicuous; palpi brownish black, the terminal segment brightened at extreme tip. Antennæ (male) exceeding one-half the length of wing; basal three segments yellow; succeeding two segments weakly bicoloured, the knot-like basal enlargements black, the remainder yellowish brown to brown, the outer segments uniformly blackened; basal enlargements very prominent; verticils subequal to or longer than the segments. Head reddish brown the



front and anterior portion of vertical tubercle more brightened; a capillary dark brown median vitta extending from the tubercle to the occiput.

Pronotum chiefly dark brown. Mesonotal præscutum with the ground-colour reddish brown, the two intermediate stripes scarcely differentiated in colour except by the narrowly darkened borders, the median dark vitta capillary; lateral stripes brown, entire but narrow; interspaces with large conspicuous setigerous punctures; posterior sclerites of notum reddish brown, the centres of the scutal lobes more darkened; a nearly continuous capillary median vitta extending from the suture to the base of abdomen; mediotergite with sparse but conspicuous setigerous punctures. Pleura reddish brown, vaguely patterned with darker. Halteres infuscated, the extreme base of stem yellow. Legs with coxæ yellow, provided with long conspicuous yellow setæ; trochanters yellow; femora obscure yellow, the tips narrowly brownish black, the amount subequal on all legs; tibiæ and tarsi dark brown, the tibial tips a little darker. Wings with the ground-colour strongly infuscated, only slightly variegated with darker brown and cream-coloured areas; cells *C* and *Sc*. with the stigma, uniform darker brown; very restricted creamy areas before and beyond stigma; in basal third of cell *M*; in bases of both anal cells and as paired areas alternating with dark spots in basal third of cell *Cu*; a single, more whitened obliterative mark across base of cell 1st *M*<sub>2</sub>, only slightly involving the ends of cells *R* and *M*<sub>3</sub>; veins brown. Venation: *Rs* long and nearly straight, exceeding twice the length of *m-cu*, cell *R*<sub>1</sub> narrow; *m-cu* on *M*<sub>4</sub> just beyond the perpendicular base.

Abdominal tergites yellow, conspicuously trivittate with black to form entire median and lateral stripes; basal sternites more uniformly yellow; subterminal segments more uniformly dark brown, the hypopygium chiefly yellow. Male hypopygium (fig. 12) with the posterior border of tergite, 9*t* conspicuously emarginate, the median region produced into an elongate lobe to form two oval sublateral notches; lateral tergal lobes subacute, glabrous. Lobe of basistyle very small, with a dense group of setæ of very unusual length. Outer dististyle long-clavate. Inner dististyle with the setæ of outer

margin long and pale, not forming a definite row as in certain allied species. Eighth sternite, 8s, with the median lobe of unusual length and narrowness, the length approximately five times the greatest diameter at base; lobe provided with elongate setæ that are chiefly apical and marginal in distribution.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Piedras Grandes, altitude 3000 metres, November 13, 1937 (*Woytkowski*).

*Tipula stenoglossa* is readily distinguished from all other members of the *monilifera* group by the coloration of the body and wings and by the details of structure of the male hypopygium, notably the tergite and eighth sternite. The tongue-like lobe of the eighth sternite is longer and narrower than in other described species.

*Tipula woytkowskiana*, sp. n.

Belongs to the *monilifera* group; general coloration of the præscutum brownish yellow, with four very slightly darker stripes, the intermediate pair separated by a capillary dark brown median line; antennæ relatively short, less than one-half the length of wing; flagellum black; basal enlargements of flagellar segments very abrupt and conspicuous; femora brown, with a narrow blackened, nearly terminal ring; wings extensively dark brown, the white colour reduced but including a conspicuous incomplete band beyond stigma; male hypopygium with caudal margin of tergite trilobed, there being a conspicuous median projection in the notch; lobe of eighth sternite elongate, nearly four times as long as width across base, provided with long conspicuous setæ.

*Male*.—Length about 15 mm.; wing 17.5 mm.; antenna about 8 mm.

Frontal prolongation of head ochreous-brown above, darker on sides, relatively elongate, exceeding the remainder of head; nasus long and slender; palpi black. Antennæ relatively short for a member of the group; scape and pedicel yellow, base of first flagellar segment brownish yellow, remainder of organ black; basal swellings unusually accentuated, each about as long as the diameter at base. Head buffy brown, the vertex with a capillary blackened median vitta.

**Mesonotal præscutum** with the ground brownish yellow, with four slightly darker stripes, the narrow intermediate pair with dusky outer margins and a common, still darker brown capillary median vitta; lateral stripes narrow, dark brown; interspaces broad, nearly as wide as the intermediate stripes, with conspicuous brown setigerous punctures; scutal lobes darkened, the median region behind more or less brightened; scutellum dark brown; mediotergite brownish grey with a blackened capillary median vitta. Pleura slightly infuscated dorsally, paling to clear yellow on ventral portion. Halteres with stem brown, yellow at base, knob dark brown. Legs with the coxæ yellow, the fore pair slightly more infuscated; trochanters yellow; femora brown with narrow blackened, nearly terminal rings; tibiæ and tarsi brownish black. Wings with the ground very extensively dark brown, the whitish colour reduced, the pattern distributed as follows:—In cell *R* with two areas adjoining vein *R* before origin of *Rs*; in cell *R*<sub>1</sub> before stigma; a conspicuous but incomplete post-stigmal band from costa into base of cell *M*<sub>3</sub>, occupying almost all of cell 1st *M*<sub>2</sub>; outer fourth of cell *R*<sub>5</sub>; major areas in *M* on basal and outer thirds of cell; other whitish areas in cell *Cu*, including a long outer streak adjoining vein *Cu*; anal cells extensively whitened, especially at bases; veins dark brown. Venation: *Rs* long and straight, about twice *m-cu*; *R*<sub>1+2</sub> complete, the distal half without trichia; cell 1st *M*<sub>2</sub> shorter than in *mitua*.

Abdomen brown, darker on lateral portions, the basal two tergites more extensively yellow; extreme caudal borders of segments pale, darkened sublaterally; basal rings of more proximal segments clearer yellow; outer segments uniformly blackened; appendages of hypopygium paling to obscure yellow; sternites obscure brownish yellow. Male hypopygium (fig. 13) with the caudal border of tergite, 9t, conspicuously tridentate, there being a median lobe in addition to the broader, nearly acute lateral blades; the central lobe shorter and weakly emarginate at apex. Outer dististyle with blade long and narrow, about one-half longer than the stem. Inner dististyle long and narrow, the basal half generally parallel-sided. Lobe of basistyle, *b*, very small, bearing a pencil of long reddish setæ that are directed ventrad.

Gonapophyses, *g*, of peculiar shape, as shown. Eighth sternite, 8*s*, with caudal margin convexly rounded, the median lobe dark coloured, long and slender, its length nearly four times the width across base, the lateral and apical portions with very long coarse yellow setæ.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huacapistana, Tarma, altitude 3600–5400 feet, March 3, 1940 (*Woytkowski*).

I take great pleasure in naming this distinct fly in honour of the collector, Mr. Felix Woytkowski, who has added so materially to our knowledge of the insects of Peru. The species is most similar to *Tipula mitua* Alexander, of Colombia, agreeing in the relatively short antennæ of the male and the long median lobe of the eighth sternite, disagreeing in the coloration of the body, antennæ and legs, and in the details of structure of the male hypopygium, as the trilobed tergite.

*Tipula innubens*, sp. n.

Belongs to the *monilifera* group; general coloration of præscutum yellow, with four narrow dark brown stripes in addition to the darkened humeral and lateral borders; nasus lacking; antennæ (male) elongate; knobs of halteres yellow; femora with a yellow subterminal ring; wings brown, conspicuously variegated with darker brown and yellowish areas, the former including three conspicuous markings in cell *Sc*; abdominal tergites reddish brown with interrupted dark brown lateral stripes; male hypopygium with the caudal margin of tergite having a tiny median incision and low sublateral lobes; lobe of eighth sternite depressed, pale, about four times as long as wide.

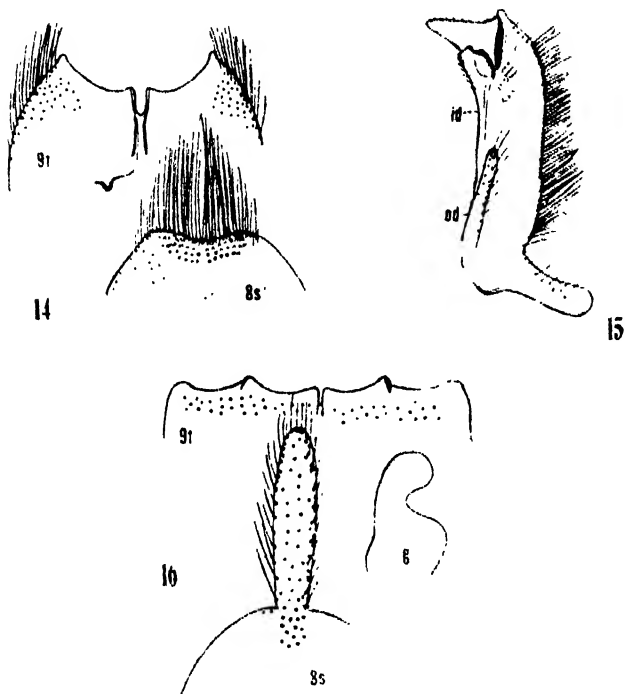
*Male*.—Length about 15–16 mm.; wing 17–17.5 mm.; antenna about 13 mm.

Frontal prolongation of head elongate, exceeding the remainder of head, obscure yellow, restrictedly darkened along sides; nasus lacking; palpi black. Antennæ (male) elongate, exceeding two-thirds the length of wing; basal three segments obscure yellow, succeeding segments weakly bicoloured, the globular basal swellings black, the remainder of segment passing into dark brown; outer segments uniformly blackened; longest verticils shorter

than the segments. Head reddish brown, the front and very narrow orbits more yellowish; central portion of posterior vertex slightly more darkened.

Pronotum variegated dark brown and buffy yellow. Mesonotal præscutum with the ground-colour yellow, with four narrow but very conspicuous dark brown stripes, the intermediate pair separated by a greyish yellow line of nearly equal width, the two stripes confluent just before the suture, with a further delicate U-shaped darkening at extreme posterior end; besides the dark stripes, præscutum with humeral and lateral portions heavily darkened; a few dark setigerous punctures on anterior interspaces; posterior sclerites of notum greyish yellow, conspicuously variegated with dark brown enclosing two areas on each scutal lobe, and a narrow but very conspicuous stripe extending from suture to base of abdomen; parascutella dark. Pleura greyish yellow, conspicuously variegated with dark brown, including a broad dorsal longitudinal stripe immediately beneath the yellow dorsopleural membrane, this latter stripe extending from the cervical region to beneath the wing-root; less distinct dark stripes and lines on the more ventral pleurites. Halteres elongate, obscure yellow at base, the stem darkened outwardly, the knob extensively yellow. Legs with the coxæ grey; trochanters yellow; femora pale brown, the extreme bases more yellow, the tips blackened, preceded by a slightly narrower clear yellow ring; tibiæ pale brown, the tips darkened; tarsi brown, the outer segments passing into black. Wings brown, conspicuously variegated with darker brown, cream-yellow and whitish subhyaline areas, the pattern unusually irregular and including zigzag areas; cell *C* brownish yellow; cell *Sc* yellow with three conspicuous dark brown markings; a restricted yellow cross-band beyond stigma; all outer medial cells with a central darkening that is narrowly bordered by yellow; unusually irregular yellow areas in cell 1st *A*, with further similar brightenings in cells *M*, *Cu* and 2nd *A*; a somewhat more whitened obliterative area across cell 1st *M*<sub>2</sub>; veins brown, more yellowish brown on interspaces of veins *Sc* and *R*. Venation: tip of vein *R*<sub>1+2</sub> very pale to atrophied; *Rs* long and nearly straight, about twice *m-cu*.

Abdomen with basal tergite obscure yellow ; succeeding tergites deeper yellow to reddish brown, with broken dark brown lateral stripes that are interrupted by the grey apical portions of the segments ; no distinct dark median stripe ; eighth segment a trifle darker ; sternites and hypopygium yellow. Male hypopygium (fig. 16) with the tergite, 9*t*, narrowly transverse, the caudal border



Figs. 14, 15.—*Tipula auricomata*, sp. n. ; male hypopygium.

Fig. 16.—*Tipula innubens*, sp. n. ; male hypopygium.

(Symbols : *g*, gonapophysis ; *id*, inner dististyle ; *od*, outer dististyle ; *s*, sternite ; *t*, tergite.)

generally truncate with a tiny median slit and low obtuse sublateral lobes. Basistyle provided with long dark setæ ; lobe of basistyle subquadrate, the apex a little widened and truncate, clothed with short dense setæ. Outer dististyle long-cylindrical, with coarse erect setæ. Inner dististyle expanded at apex ; outer margin with weak

erect setæ that are not arranged in rows. Gonapophyses, *g*, obtusely rounded at tips. Eighth sternite, 8s, with the median lobe depressed, pale, with coarse pale setæ from darkened punctures; lobe a little more than four times as wide; no major setæ on sternite excepting a median series extending backwards from the lobe.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huasahuasi, Tarma, altitude 2800 metres, April 23, 1940 (*Woytkowski*). *Paratopotype*, ♂, April 10, 1940.

The present fly is very different from all other described species of the *monilifera* group, especially in the lack of a nasus, the pattern of the femora and wings, and in the details of structure of the male hypopygium. It is, perhaps, as close to *Tipula woytkowskiana*, sp. n., as to any other form, yet very distinct.

*Tipula auricomata*, sp. n.

Belongs to the *monilifera* group; flagellar segments of male antennæ abruptly nodulose, the organ about one-half the length of wing; basal flagellar segments strongly bicoloured; wings with a strong brown tinge, striped longitudinally with pale yellow, including two major streaks, one extending from the outer end of cell *R* through 1st *M*<sub>2</sub> to wing-apex in cell *R*<sub>5</sub>, the second stripe chiefly in the bases of the anal cells, continued along cell *Cu* almost to wing-margin; male hypopygium with conspicuous tufts of yellow setæ on lobes of ninth tergite, ventral portion of basistyle, and especially as two flattened groups on posterior border of eighth sternite, which is otherwise unarmed.

*Male*.—Length about 14–15 mm.; wing 16–17 mm.; antenna 8–9 mm.

Frontal prolongation of head grey above, darker on ventral half; nasus elongate, yellow; palpi brownish black, the incisures paler. Antennæ (male) moderately elongate, about one-half the length of wing; basal three segments yellow, succeeding segments strongly bicoloured, the basal knot black, the stem yellow; outer segments passing through feebly bicoloured to uniform brownish black by a gradual darkening of the stem of the segment; basal knots of segments abruptly developed as in the

typical members of the group. Head ashy grey, variegated with brown, including a more or less distinct median line.

Pronotum grey with a median brown vitta. Mesonotal præscutum brownish grey, with three brown stripes, the median one pale brown, distinctly divided by a capillary dark brown vitta and with the lateral borders vaguely infumated; lateral stripes anrow, medium brown; setigerous punctures of the interspaces dark brown, conspicuous; posterior sclerites of notum brownish grey; lobes of scutum patterned with darker brown; scutellum with an anchor-shaped brown marking; mediotergite with a capillary brown dash, narrowed behind. Pleura yellowish grey, scarcely patterned with darker. Halteres brown, the base of stem restrictedly brightened. Legs with coxæ grey; trochanters yellow; femora obscure yellow with a narrow brown nearly terminal ring; tibiæ brownish yellow, the tips narrowly dark brown; tarsi passing into black; claws toothed. Wings with a strong brown tinge, patterned with pale yellow, chiefly as two narrow longitudinal stripes, the more cephalic extending from outer end of cell *R* through 1st *M*<sub>2</sub> to the wing-apex in *R*<sub>5</sub>, including almost all of the latter cell and, in cases, the adjoining portions of cells *M*<sub>1</sub> and 2nd *M*<sub>2</sub>; the second pale stripe includes most of cell *Cu* and the bases of the anal cells, not reaching the wing margin in cell *Cu*; cells *C* and *Sc* brownish yellow, unpatterned; veins brown. Venation: *R*<sub>1+2</sub> entire but pale; cell *M*<sub>4</sub> deep.

Abdominal tergites obscure yellow, with three brown stripes, the lateral pair narrow and broken; sternites and hypopygium chiefly yellow. Male hypopygium (figs. 14, 15) large. Ninth tergite, 9*t*, with the caudal border broadly emarginate, with a narrow secondary median notch; lateral lobes at apex relatively narrow, the outer margins with groups of long yellow setæ. Basistyle complete, its ventral portion with a group of long setæ. Outer dististyle, *od*, appearing as a small lobe, at base more or less fused with the inner style. Inner dististyle, *id*, with outer margin bearing a single series of about forty-five strong powerful spinous bristles, the outer ones shorter and slightly stouter, the bristles terminating in a delicate hair; outer margin of style at base produced into a conspicuous flattened pale blade,



the apex obtuse. Eighth sternite, 8s, narrowed posteriorly. the apex more or less membranous, bearing two flattened brushes of long yellow setæ. the ones nearer the median line longer.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Piedras Grandes, Huanuco, altitude 3000 metres, November 17, 1937 (*Woytkowski*). *Paratopotypes*, 2 ♂♂, November 12-14, 1937. *Paratype*, 1 ♂, Huanuco, altitude 2,000 metres, September 15, 1937 (*Woytkowski*).

*Tipula auricomata* is entirely distinct from all other members of the *monilifera* group, differing especially in the longitudinally striped wings and the peculiar structure of the male hypopygium, notably the conspicuous hair-tufts on the eighth sternite. The single row of spinous setæ along the outer margin of the inner dististyle is somewhat as in the otherwise very different *T. pantherina* Alexander, of Venezuela.

*Tipula tephronota*, sp. n.

General coloration of mesonotum dark brown, with a broad ash-grey central stripe extending the entire length, this contrasting abruptly with the lateral borders; frontal prolongation almost in alignment with remainder of head; antennæ with basal two segments yellow, flagellum beyond the elongate first segment black; legs dark, the femora black, narrowly yellow at bases, with a narrow obscure yellow subterminal ring; wings whitish hyaline, the prearcular field and costal border narrowly but continuously dark brown; weak brown washes elsewhere on wing-disk; *Rs* long, exceeding one and one-half times *m-cu*; basal abdominal segments yellow, the tergites patterned with darker, tergites five to seven, uniformly black; cerci long and slender.

*Female*.—Length about 17 mm.; wing 15.5 mm.

Frontal prolongation of head black, more reddish or piceous on sides of dorsal half; nasus lacking; prolongation subequal in length to remainder of head, without a marked depression between it and remainder of front; palpi black, the terminal segment of moderate length. Antennæ with scape and pedicel light yellow; first flagellar segment brown; remainder of flagellum black; first flagellar segment elongate, about equal to

the succeeding two combined ; outer flagellar segments short, with conspicuous basal enlargements ; verticils considerably longer than the segments. Head brownish grey, the posterior vertex conspicuously patterned with brown on central portion and as large areas behind the eyes ; no vertical tubercle.

Pronotum brown, with a more buffy spot on either side of mid-line. Entire mesonotum with a broad central ash-grey stripe, on the mediotergite a trifle more brownish grey ; præscutum with lateral and humeral third abruptly dark brown ; lateral half of each scutal lobe similarly dark brown ; parascutella darkened. Pleura uniformly deep yellow, the propleura and dorsopleural membrane to wing-root abruptly dark brown. Halteres with stem brown, the knob still darker. Legs relatively long and slender ; coxæ light yellow, the fore pair slightly darker ; trochanters yellow ; femora black, the bases narrowly and abruptly light yellow ; a narrow obscure yellow subterminal ring more than twice its length back from tip ; tibiæ and basitarsi brown, the tips still darker ; remainder of tarsi black. Wings with the ground-colour whitish hyaline, the prearcular and costal fields, with the stigma, uniformly and continuously dark brown ; remainder of wing weakly washed with brown, including the apical cells beyond the level of outer end of cell 1st  $M_2$ , and less evident washes in basal cells, the most distinct appearing as a cloud along vein  $Cu$  in cell  $M$  at about two-thirds the length, and a seam on distal section of vein  $Cu_1$  ; axilla and vein 2nd  $A$  more narrowly seamed ; veins brown. Venation :  $Sc$  long,  $Sc_2$  ending shortly before distal end of long straight  $Rs$  ; tip of  $R_{1+2}$  pale but preserved ; petiole of cell  $M_1$  nearly twice  $m$  ; cell 2nd  $A$  relatively wide.

Abdomen with basal segments light yellow, the outer segments black ; tergites two to four with the posterior borders and a weak central line brown, the latter becoming much wider on the fourth tergite ; tergites five to seven, inclusive, uniformly black ; tergite eight and the genital shield slightly paler, especially the basal portion of the latter. Ovipositor with the valves horn-coloured, the long cerci slender and straight.

*Hab.* Peru (Huanuco).

*Holotype*, ♀, Piedras Grandes, altitude 3000 metres. November 21, 1937 (*Woytkowski*).

*Tipula tephronota* is very different from all described species of the genus in the Andean fauna. Despite the very different coloration, the fly appears to be most closely related to species such as *T. abortiva* Alexander, *T. campa* Alexander, *T. curinao* Alexander, and *T. piro* Alexander, all from the vicinity of Callanga, Peru.

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XXX.—*New Malaysian Hylobiinae* (Col., Curcul.).

By Sir GUY A. K. MARSHALL, F.R.S.

THE weevils of the subfamily Hylobiinae, as at present known, are most abundantly represented in Tropical America, but the tropics of the Oriental Region are likely to prove nearly as rich in species when this area has been more adequately searched. The continent of Africa presents a striking contrast in this respect, having so far yielded only 23 described species (contained in 9 genera), the total for the subfamily being about 1150 species (in 110 genera). Even the Palearctic Region presents 30 species in the genus *Hylobius* alone.

The great majority of the species here described have been received through the kindness of Mr. H. M. Pendlebury, Officer-in-Charge, Selangor Museum, and in most cases cotypes of them will be found in that Museum, the types being in every case preserved in the British Museum.

*Pagiophlæus tuberosus*, sp. n.

♂♀. Dull black, with scattered shiny tubercles and granules and very sparse fulvous setiform scales above, which form denser patches on the lateral basal angles of the elytra, in the middle of the prosternum and mesosternum, and on the hind coxæ; along the side of the propleuræ and extending to the front of the prosternum and the basal angle of the elytra, a stripe of dense white or yellowish powder.

*Head* with coarse confluent punctation and a slight obtuse elevation in the middle, the forehead with a large deep fovea. *Rostrum* as long as the pronotum, rather stout, curved, gradually narrowed from the base to the middle then dilated to the apex; dorsum with large rugose punctures and five narrow irregular sinuous carinae, the three median ones uniting close to the base, the middle one not more conspicuous than the others; the apical margin with a small median projection. *Antennae* black, stout; joint 1 of funicle much longer than 2, 3-7 subequal and transverse. 7 somewhat wider and distinct from the club, which is large, elliptical, with the sutures partly oblique. *Prothorax* as long as broad, rounded laterally, widest at the middle, with a broad collar-like constriction at the apex, which is arcuate dorsally, the post-ocular lobes distinct, the gular margin deeply sinuate; dorsum strongly convex longitudinally, set with large deep foveae, the raised margins of which bear low shiny granules, and in the middle of the disk a high rugose elongate tubercular elevation. *Scutellum* shield-shaped, as long as broad, depressed in the middle, with dense shallow punctures, bare. *Elytra* much wider than the base of the prothorax, widest at the shoulders, gradually narrowing behind, deeply constricted subapically, the apices each with a short subconical process; the shallow striae containing more or less irregular rows of large round separated punctures, each containing a short recumbent fulvous seta; the intervals narrow, uneven and very irregular, the alternate ones bearing a row of distant subconical shiny punctate tubercles, there being four or five on interval 3, five on 5 (alternating with those on 3), five or six much smaller ones on 7, and a single small conical one on 9 behind and below the shoulders; the other intervals with variable rows of low shiny distant granules. *Legs* stout, black, with sparse fulvous and white setae; femora very rugose apically; front tibiae strongly curved at the base, then straight to the apex, with a very large triangular tooth in the middle of the lower edge, middle tibiae with a much smaller one, hind pair only obtusely angulate at the middle. *Underside* with coarse shallow subconfluent punctures in the middle of the metasternum, becoming sparser laterally; ventrite

1 of ♂ somewhat tumid in the middle, with very rugose punctures, 2-4 with sparse obsolescent punctures; ventrite 1 of ♀ with the punctures small, sparse and obsolescent.

*Length* 12.0-15.5 mm., breadth 7-7.5 mm.

CEYLON: 1 ♂, 1854; 1 ♂, 1910 (*G. W. Bury*—type); Kandy, 1 ♂, ix. 1907 (*E. E. Green*). INDIA: Himalaya, 1 ♂ (coll. *D. Sharp*). INDO-CHINA: Cambodia, 1 ♂ (*Monhot*); Tonkin, Hagiang, 1 ♀, v. 1914 (*R. Vitalis*).

The Himalaya record seems perhaps dubious.

Nearly allied to *P. javanicus* Fst. 1892, which has been found also in the Malay States (Cameron Highlands, 4700-5200 ft., Pahang, and Bukit Kutu, Selangor). But *javanicus* differs in having no elevation on the head; the dorsal area of the rostrum is strongly compressed basally in the male, rather less so in the female; the foveæ on the pronotum and the punctures on the metasternum and basal ventrite are much shallower; and the larger tubercles on the elytra are elongate and not conical.

*Pagiophlæus erosus*, sp. n.

♂♀. Black, rather shiny; prothorax and rostrum with very sparse recumbent setæ which are mainly fulvous dorsally and white laterally; elytra with small irregular spots of short setiform white and fulvous scales, mostly on the sides and declivity; underside with sparse setiform scales, which are denser on the mesosternal process and the base of the metepisterna and round the mid-coxæ, also forming a row of spots on each side of the venter.

*Head* very coarsely punctate anteriorly, with a very large frontal fovea, which has a smooth oblique carina on each side of it; eyes convex. *Rostrum* about as long as the pronotum, slightly narrowing from the base to the middle then widening to the apex, the dorsal outline straight from the base to the antennæ (which are very close to the apex) and there abruptly and very steeply declivous; the dorsum with a coarsely punctate flat median ridge, the very rugose lateral areas sloping steeply on each side of it, the oblique carinæ on the forehead continuing on to the basal half of the rostrum; the

declivous area with small variable punctures and a very large median fovea ; submentum of ♂ with a stout vertical tooth. *Antennae* short, stout, black ; funicle with joint 1 much longer than 2, 3-7 transverse, 7 much broader than the others, pubescent like the club and annexed to it ; club large, broadly ovate, with the sutures straight. *Prothorax* about as long as broad, feebly rounded laterally (sometimes parallel-sided in the basal third), narrowing in front, with a shallow apical constriction, the apex strongly arcuate dorsally, the postocular lobes obsolete, the gular margin very shallowly sinuate : dorsum with a large irregular smooth cruciform tubercle beyond the middle, the longitudinal arms of the cross sometimes extending to form a median carina from base to apex but usually abbreviated, the lateral arms short ; the very large foveae on the disk arranged more or less like a rosette around the tubercle, the foveolae on the pleurae much smaller than those on the disk. *Scutellum* subtriangular, sloping steeply at its base, with a very shallow median impression, bare. *Elytra* fully one-third wider than the prothorax, broad, almost parallel-sided from the prominent shoulders to the middle, jointly and obtusely rounded behind, deeply constricted subapically, with large obtuse posterior calli ; the very large dorsal foveae somewhat irregular and more or less laterally confluent, so that the lower intervals (2, 4, 6) are almost obliterated, except near the apex, interval 3 higher than the others, with a high ridge near the base followed by a broad interruption. *Legs* unevenly clothed with sparse white setiform scales forming a band below and beyond the clavate part of the femora ; tarsi with dense yellowish-white setiform scales. *Underside* with variable large shallow punctures on the sternum and sparse fine ones on the venter, except on ventrite 5 which is rugosely punctate.

*Length* 11-16 mm., breadth 4.8-7.0 mm.

FEDERATED MALAY STATES : Selangor, The Gap, 2700 ft., 1 ♂, i. 1915 ; Selangor, Bukit Kutu, 1 ♀, iv. 1915 ; Pahang, Fraser's Hill, 4200 ft., 1 ♂, 1 ♀, vii. 1933 (*N. C. E. Miller*—type), 1 ♀, vii. 1936 (*H. M. Pendlebury*) ; Pahang, Cameron Highlands, Gunong Perдах, 5170 ft., 1 ♂, v. 1939 (*H. M. P.*).

A very distinct species, characterised by the very coarse sculpture of the elytra and the very steep and abrupt declivity at the apex of the rostrum.

*Dyscerus anceps*, sp. n.

♂♀. Derm reddish brown, the head and prothorax a little darker, and the apices of the femora blackish: sparsely clothed with uniform small pale fawn scales above and below.

*Head* with dense small punctures and a deep frontal fovea: eyes flat. *Rostrum* as long as the pronotum, comparatively slender, subcylindrical, only very slightly widened at the apex, the dorsal outline regularly curved from base to apex, with dense longitudinally confluent punctures, leaving a well-defined smooth narrow median carina (extending to the antennæ in ♂ and to the middle in ♀) and two indistinct undulating carinæ on each side; the apical area with dense fine punctures in ♂, these being much smaller and sparser in ♀. *Antennæ* slender, red-brown; the two basal joints of the funicle elongate and equal, the last three moniliform, 5 and 6 as long as broad, 7 very little wider, slightly transverse, quite distinct from the club, glabrous; club broadly fusiform, with the sutures somewhat oblique. *Prothorax* as long as broad; parallel-sided in the basal third, narrowing in a gentle curve to the apex, which is very shallowly constricted, the dorsal apical margin truncate or feebly arcuate, the postocular lobes moderate, the gular margin rather deeply sinuate; dorsum almost flat longitudinally in the middle, with coarse subconfluent punctation, the narrow intervals being slightly higher in some parts, with a low narrow median carina (sometimes indistinct) on the anterior half; the scales a little larger than those on the elytra. *Scutellum* subtriangular, bare, with fine shallow punctures. *Elytra* more than one-third wider than the prothorax, elongate, parallel for two-thirds the length, constricted subapically, with obtuse posterior calli, the apices shortly and separately acuminate; the broad striæ containing moderately large foveolæ, which are much smaller and shallower close to the base and each containing a scale, these scales widest near the

base and gradually diminishing behind; the intervals narrower than the foveolæ, with an irregular row of small flattened granules, somewhat uneven owing to small depressions at irregular spaces, these depressions transversely wrinkled and almost devoid of scales or granules. *Legs* slender, red-brown with the apices of the femora blackish, with sparse even scaling; tarsi not densely squamose; tibiæ curving inwards apically.

*Length* 11–17 mm., breadth 4–5 mm.

FEDERATED MALAY STATES: Perak, Larut Hills, 3700–4500 ft., 3 ♂, 2 ♀, ii. 1932 (*H. M. Pendlebury* -- type); Perak, Gunong Hijau, 2000–5000 ft. (*Doherty*). BORNEO: Mt. Kinabalu, Lumu Lumu, 5500 ft., 1 ♀, iv. 1929 (*H. M. P.*).

Apparently allied to Heller's *D. cervinus* and *sparsutus* (known to me from description only) from Sumatra. The former differs, however, in having the three median carinæ on the rostrum united at the base and joint 1 of the funicle longer than 2; and *sparsutus* is distinguished by having no median carina on the pronotum.

*Dyscerus nubifer*, sp. n.

♂♀. Derm black, with sparse ovate yellow scales above and below, with some denser spots on the elytra, normally forming a pattern very similar to that in *proximus* Hartm.

*Head* with very shallow confluent punctation and a small shallow frontal fovea, the forehead nearly as wide as the base of the rostrum; eyes flat. *Rostrum* a little longer than the pronotum, moderately stout, sub-cylindrical to the antennæ, then distinctly and rather abruptly widened at the apex, only very slightly curved, with six shallow sulci containing confluent punctures and separated by low narrow carinæ, the median carina bifurcated at the apex and the three median ones uniting at the base; the apical area coarsely punctate in both sexes, with an oblique sulcus on each side. *Antennæ* rather stout, blackish; joint 1 of the funicle a little longer than 2, 3–6 moniliform and about as long as broad, 7 wider, transverse, pubescent, quite distinct



from the club, which is broadly fusiform, with the sutures somewhat oblique. *Prothorax* as long as broad, parallel-sided in the basal third, then narrowing gradually in a curve to the apex, which is not constricted, the dorsal apical margin feebly arcuate, the postocular lobes distinct, the gular margin deeply sinuate; dorsum almost flat longitudinally in the middle, very coarsely and confluent punctate, sometimes with a trace of an irregular median carina; the scales small and ovate, usually narrower and sparser on the disk. *Scutellum* subtriangular, bare, finely punctate. *Elytra* one-half wider than the prothorax, parallel to two-thirds, constricted subapically, with obtuse posterior calli, the apices shortly and separately acuminate; the shallow striae indistinct or almost obliterated on the basal two-thirds, owing to the septa between the punctures coalescing laterally and forming transverse wrinkles, while on the posterior declivity both striae and punctures become almost obsolete; the intervals narrow and irregular, with flattened granules which often form part of the transverse wrinkles. *Legs* slender, uniform piceous brown, very sparsely setose; tibiae incurved apically.

*Length* 11.5–14.0 mm., breadth 4.5–5.5 mm.

BORNEO: Mt. Kinabalu, Kamborangah, 7000 ft., 2 ♀, iv–v, 1929, and Lumu Lumu, 5500 ft., 1 ♂, 1 ♀, iv, 1929 (*H. M. Pendlebury*).

Closely allied to *D. cervinus* Hllr., which, however, differs in having no scale pattern on the elytra, the humeral and posterior calli being bare and shiny, and the rows of punctures are much deeper and more distinct.

*Dyscerus rotundicollis*, sp. n.

♂♀. Derm dull black, opaque, set with separated small narrow yellowish scales, which form denser, mostly transverse patches on the elytra, as follows:—at one-fourth from the base a short band between striae 1 and 3 and another between 8 and 10; immediately behind these a similar band between striae 4 and 7; a little behind the middle a less distinct band on intervals 1 to 3; at the top of the declivity a macular band, becoming very indefinite laterally; just behind the posterior callus a

spot on int. 3 and another on 9. Some of these markings are sometimes reduced or absent.

*Head* with the forehead about half as wide as the base of the rostrum, rugosely punctate and with a deep median fovea; eyes flat. *Rostrum* as long as the pronotum, moderately stout, subcylindrical to the antennæ, then gradually dilated, regularly curved from base to apex, with a deep depression between base and forehead in ♂, much shallower in ♀; ♂ with coarse confluent punctation and five carinæ from base to antennæ, these extending only to about middle in ♀, the three median carinæ uniting at the base. *Antennæ* red-brown; funicle with the basal joints equal, 3-6 moniliform and about as long as broad, 7 scarcely wider, slightly transverse and pubescent, quite distinct from the club, which is broadly fusiform with the sutures somewhat oblique. *Prothorax* of ♂ slightly broader than long, strongly rounded laterally, widest at the middle, with a shallow apical constriction which continues across the dorsum, the apical margin feebly arcuate dorsally, the postocular lobes distinct, the gular margin deeply sinuate; dorsum longitudinally convex, highest beyond the middle, with coarse punctures that are more or less confluent obliquely, some of the intervals being more raised than the others, and with a low sinuous median carina on the apical half; prothorax of ♀ much narrower, as long as broad, much less rounded laterally. *Scutellum* subtriangular, bare. *Elytra* one-third wider than the base of the prothorax, parallel for two-thirds the length, constricted subapically, with large obtuse posterior calli, the apices separately acuminate; the very shallow striae containing large subquadrate punctures, which rapidly diminish behind and almost disappear on the declivity, each puncture containing a small scale, but larger than those on the intervals; intervals not wider than the punctures, somewhat uneven, with rather sparse granules of unequal size which also form small irregular groups, each granule with a short recumbent scale-like seta. *Legs* slender, dark red-brown with the knees black, with rather sparse setiform scales; femora rugosely punctate, except on the clavate part, which is smooth and almost impunctate or finely wrinkled; all the tibiæ curving strongly inwards at apex.

*Length* 10–13 mm., *breadth* 3·5–5·0 mm.

**FEDERATED MALAY STATES:** Perak, mountains, 1 ♀ (*Doherty*); Perak, Larut Hills, 500–4500 ft., 2 ♂, ii. 1932, vi. 1938 (*H. M. Pendlebury*—type); Selangor-Pahang border, Semangko Pass, 2700 ft., 2 ♀, iii. 1912; Selangor, Kuala Lumpur, 1 ♂; Selangor, Bukit Kutu, 1 ♂, iv. 1915; Negri Sembilan, Gunong Angsi, 2000–2790 ft., 4 ♂, 3 ♀, iv. 1918.

This species is extremely similar to *D. proximus* Hartm., with which it has certainly been confused hitherto, because the colour-pattern is almost identical. But *proximus* differs in having the derm shiny instead of opaque; the legs are entirely black, with the tibiae only slightly incurved at the apex; the prothorax of ♂ is as long as broad, much less strongly rounded laterally, and widest behind the middle; and in the male aedeagus the truncate apical piece is only one-fourth the width of the main tube, whereas in *rotundicollis* it is much wider, being half the width of the tube.

*Dyscerus deceptor*, sp. n.

♂♀. This is another species having the same elytral pattern as that of *proximus*, but the prothorax has on each side a very faint curved lateral stripe. The description of *rotundicollis* applies to it except in the following particulars:—

*Rostrum* appreciably less curved and less convex transversely. *Prothorax* very slightly longer than broad in both sexes, much less strongly rounded laterally, less convex longitudinally, widest behind the middle, not constricted at the apex, much less coarsely punctate, with the intervals less uneven, and with a much longer median carina, extending from the apical margin to three-fourths; a constant small round lateral spot of dense scales at about the middle, invisible from above. *Elytra* not opaque, somewhat shiny, normally with more numerous scales. *Legs* with the anterior pairs of tibiae only slightly curved inwards at the apex. *Aedeagus* of ♂ abruptly narrowed near the apex and produced in the middle into a narrow, upwardly curved hook.

*Length* 11·0–12·5 mm., *breadth* 3·8–4·5 mm.

FEDERATED MALAY STATES: Perak, mountains, 1 ♂ (*Doherty*—type); Selangor, Bukit Kutu, 3000–3400 ft., 2 ♂, iv. 1915, 2 ♂, ix. 1932 (*H. M. Pendlebury*); Pahang, Fraser's Hill, 4200 ft., 1 ♂, vii. 1931 (*H. M. P.*); Pahang, Cameron's Highlands, Tanah Rata, 4800 ft., 1 ♀, v. 1931 (*H. M. P.*).

An even closer ally of *deceptor* is the Javanese *proximus* Hartm., which is rather smaller (10–11 mm.), with an almost identical elytral pattern, but the spots appear much more distinct owing to the general scaling being much sparser and the individual scales smaller; the prothorax is slightly broader than long, with a much shorter median carina on the apical half only; shallowly constricted at the apex, and with the apical area more strongly punctate; the rostrum is more curved; and the male aedeagus is very different, being gradually narrowed to the truncate apex.

*Dyscerus plenus*, sp. n.

♀. Derm black, rather shiny; prothorax bare, except for an elongate, apically fringed, yellowish scale in each puncture and a sigmoid lateral stripe of similar but denser scales, which are sprinkled with yellowish powder, and below this stripe near the middle a small round spot of similar scales; elytra with markings just like those of *D. rotundicollis*, sp. n., but with the addition of a short yellowish stripe at the base of the suture and a patch in the basal angles beneath the shoulders, while there is only a single spot behind the subapical callus instead of two; the sparse general scaling of the latter species appears, however, to be absent, there being only a single irregular row on each interval of fringed scales like those on the pronotum but smaller, the other scales being reduced to microscopic setae.

Head with the forehead slightly less than half as wide as the base of the rostrum, the punctures close but not confluent or rugose. Rostrum as in *rotundicollis*, but much less strongly curved in the basal half, the dorsal outline being almost continuous with that of the forehead. Antennae dark piceous; joint 1 of the funicle a little longer than 2, otherwise as in *rotundicollis*. Prothorax of

the same shape in the two sexes, as long as broad, moderately rounded laterally, widest slightly behind the middle, rather more strongly constricted at the apex than in the allied species, the postocular lobes almost obsolete, the gular margin more shallowly sinuate; dorsum moderately convex longitudinally (more so in ♀), highest beyond the middle, with coarse obliquely-confluent punctures and an obtuse abbreviated median carina, which is broader and higher than in allied species, especially in ♀. *Scutellum* transverse, shallowly impressed in front, bare. *Elytra* of the same shape as in *rotundicollis* but with a short sharp process at the apex of each; the dorsum moderately shiny, with much larger oblong punctures, which are broader than the intervals; the scales in the punctures minute, smaller than those on the intervals. *Legs* black, with sparser pale setæ; *tibiae* moderately curved inwards at the apex.

*Length* 11.5–12.5 mm., breadth 4–5 mm.

FEDERATED MALAY STATES: Perak, Larut Hills, 4500 ft., 1 ♂, 1 ♀, ii. 1932 (*H. M. Pendlebury*).

Easily distinguished from other members of the *proximus* group by the additional markings on the elytra, which have the apices much more sharply pointed, the greatly reduced postocular lobes on the prothorax, joint 1 of the funicle longer than 2. and by the aedeagus gradually narrowing to a point.

*D. plenus rutensis*, subsp. n.

In the Cameron Highlands *D. plenus* occurs in a slightly modified form: the scales are slightly longer and narrower, the markings being less sharply defined; the processes at the apex of the elytra are somewhat longer; and the apical portion of the male aedeagus is more produced and much more sharply pointed.

FEDERATED MALAY STATES: Pahang, Cameron Highlands, 4500–4800 ft., 1 ♀, vi. 1935 (*H. M. Pendlebury*); Cameron Highlands, Tanah Rata, 4600 ft., 2 ♂, vi. 1940 (*N. C. E. Miller*—type).

APTERYLOBIUS, gen. nov.

The species for which this genus is proposed might be described as a flightless *Dyscerus*, the wings being greatly

reduced and non-functional. They differ also from that genus in having the elytra jointly truncate at the base and without any trace of humeral calli; the anterior part of the prosternum is as long as a front coxa (shorter in *Dyscerus*); the metasternum is not longer than a median coxa (longer in *Dyscerus*); and the dorsal fringe of the corbel of the hind tibiae is much shorter than the first tarsal joint (as long as the first tarsal in *Dyscerus*).

From *Euthycus*, which is wingless, *Apterylobius* differs in general facies owing to its quite regular punctate striae on the elytra; further it has a distinct scutellum; the elytra are transversely truncate at the base (sinuate in *Euthycus*), not produced downwards at the apex, but each bearing a short sharp process; the slender, feebly clavate hind femora reach the apex of the elytra; and in *Euthycus* the fringe of the corbel of the hind tibiae is as long as the first tarsal joint.

Genotype: *Apterylobius cinctus*, sp. n.

The Bornean *Euthycus basalis* Heller also belongs to this genus.

*Apterylobius cinctus*, sp. n.

♂♀. Dull black, with sparse narrow fulvous scales, which are denser along the base and sides of the elytra; elytra with a sharply defined common narrow band of white setiform scales (normally dusted with a whitish powder) extending to the lateral margin at about one-third from the base; underside with sparse setiform fulvous scales.

*Head* with moderately close punctures varying much in size on the anterior part, the vertex with sparse minute punctures; forehead about two-thirds as wide as the base of the rostrum, with a median fovea of variable depth; convexity of the eyes continuous with that of the head. *Rostrum* as long as the pronotum, with rugose sub-confluent punctures without definite carinae on the basal two-thirds in ♂ (on the basal half in ♀), the apical area with very fine shallow punctures. *Antennae* with joint 1 of the funicle longer than 2, the distal joints moniliform, with 7 rather larger and pubescent, but distinct from the club, which is elongate (as long as the last five joints of

the funicle) and widest beyond the middle. *Prothorax* as long as broad, parallel-sided, slightly narrowed for a very short distance at the base and shallowly constricted at the apex, the base truncate, the postocular lobes well developed, the gular margin sinuate; dorsum gently convex longitudinally, highest at the middle, with rugose shallow confluent punctures, having the intervals more or less granulate, and a low abbreviated median carina on the anterior half. *Scutellum* transverse, bare, impunctate. *Elytra* elongate, moderately rounded laterally, widest well behind the middle, a little wider at the sharply truncate base than the prothorax, with the basal angles rectangular, without any posterior calli, the apices each produced into a short sharp process; dorsum moderately convex longitudinally, highest at the middle, gradually declivous behind; striae broad and deep, the punctures in front of the white band very large and deep, but small and shallow behind it; intervals strongly convex, all of the same height, minutely subgranulate, narrower and somewhat uneven in front of the white band, smooth and regular behind it. *Legs* very slender, with sparse short pale recumbent setae; femora feebly clavate, strigose, with a small sharp tooth, hind pair reaching the apex of the elytra; tibiae feebly bisinuate on the inner edge.

*Length* 9–11 mm., breadth 3–4 mm.

BORNEO: Mt. Kinabalu, Kamborangah, 7000 ft., 2 ♂, 2 ♀, iii.–iv. 1929 (*H. M. Pendlebury*).

A single ♂ taken by the same collector on the same mountain, but much higher up, at Pakka, 10,000 ft., iii. 1929, differs from the typical form in having the sides of the prothorax slightly rounded laterally, while the white band on the elytra is replaced by a narrower indistinct macular band formed of fulvous scales. This may prove to be an alpine race and may be designated var. *subcinctus*, nov.

The only other species of this genus (*Euthycus*) *basalis* Heller, is also an inhabitant of Mt. Kinabalu, the only two specimens for which precise data are available having been taken at Lumu Lumu, 5000 ft., iii. 1929, and at Kenokok, 3300 ft., iv. 1929 (*H. M. Pendlebury*), respectively. It differs from *cinctus* in the following characters:—

the setiform scales on the pronotum are whitish and the elytra have a large fulvous patch on each side of the base ; rostrum a little longer and narrower ; scape red-brown and the two basal joints of the funicle equal ; prothorax rounded laterally ; elytra rather deeply depressed transversely close to the base, the margin being strongly elevated, with rows of large foveolæ which are much wider than the intervals ; femora more strongly clavate and the tibiæ more deeply bisinuate.

*Euthycus pendleburyi*, sp. n.

♂♀. Dull black, with very sparse minute fulvous scales, which are much larger and denser only on the tops of the tubercles on the elytra ; underside with very sparse fulvous setæ.

*Head* rugosely punctate, the forehead much narrower than the base of the rostrum, with a broad transverse depression ; eyes moderately convex, being more convex than the temples, which bear fine irregular striæ behind the eyes. *Rostrum* shorter than the pronotum (3 : 4), stout, with large irregular rugose punctures, without any trace of carinæ, the dorsal outline of the base raised above the forehead, the dilated declivous apical part with a shallow median sulcus. *Antennæ* with joint 2 of the funicle longer than 1, 3-7 transverse. *Prothorax* longer than broad (4 : 3), subcylindrical, slightly rounded laterally in the middle, shallowly constricted at one-fourth from the apex, bisinuate at the base, the postocular lobes obsolete, the gular margin broadly and deeply sinuate ; dorsum uneven, with very rugose confluent punctures, some of the intervals raised or subgranulate, without any definite median carina. *Elytra* scarcely wider at the base than the prothorax, almost parallel-sided for a short distance from the base, then rounded laterally, widest behind the middle, jointly rounded at the apex, which is produced downwards in both sexes, the posterior declivity steep ; dorsum rather strongly convex longitudinally, highest behind the middle, with rather irregular rows of foveolæ ; the dorsal ones having a rather shiny flat granule on each of the septa ; the intervals not wider than the foveolæ, 2, 4, and 6 bearing rows of tubercles that are squamose at



the apex, 2 with six or seven, 4 with two or three, 6 with four, 5 with a single squamose tubercle at its apex. and 3 with an angulate elevation at the base. *Legs* with shallow subconfluent punctation and short sparse setæ; femora with a small tooth; tibiæ not dilated on the inner edge.

*Length* 9.5–11.0 mm., breadth 3.5–4.5 mm.

**FEDERATED MALAY STATES:** Perak, Batang Padang, Jor Camp, 2000 ft., 2 ♂, 2 ♀, ii.–iii. 1915, 2 ♀, viii. 1922 (*E. Seimund*), 1 ♀, vi. 1923 (*F. N. C.*), 1 ♀, iii. 1924 (*H. M. Pendlebury*); Selangor, Ginting Bidai, 2000 ft., 4 ♂, 1 ♀ (*C. B. Kloss*); Pahang, Fraser's Hill, 4200 ft., 1 ♂, 1 ♀, vii. 1936 (*H. M. P.*); Pahang, Cameron Highlands, Ginting Kial, 5000 ft., 1 ♀, v. 1939 (*H. M. P.*).

In Dr. K. M. Heller's key to the genus (*Deutsch. Ent. Zeits.* 1922, p. 12) this species runs down to *E. macilentus* Pasc., from Java and Borneo, which it closely resembles. Pascoe's species, however, has the eyes quite flat, the forehead is not depressed, the rostrum and antennæ are much more slender, and the distal joints of the funicle are as long as or longer than broad.

*Euthycus gracilis*, sp. n.

♂. Dull black, with sparse short pale fulvous setæ above and below, without any patches of scaling.

*Head* rugosely punctate, the forehead flat and somewhat narrower than the base of the rostrum; eyes moderately convex, a few fine striæ on the temples behind them. *Rostrum* shorter than the pronotum (7:9), with coarse irregular punctation, without any definite carinæ, the dorsal outline of the base continuous with that of the forehead, the dilated declivous apical part without any median sulcus. *Antennæ* with joint 2 of the funicle longer than 1, 3–6 transverse, 7 as long as broad. *Prothorax* longer than broad (5:4), subcylindrical, slightly rounded laterally in the middle, constricted at one-fourth from the apex, bisinuate at the base, without any trace of postocular lobes, the gular margin broadly but shallowly sinuate; dorsum highest at the apex and sloping straight to the base, with very coarse rugose punctures, the intervals between them somewhat unequally raised,

without granules or a median carina. *Elytra* narrowly elongate, very slightly wider at the base than the prothorax, gently rounded laterally, very gradually widening from the base to a little behind the middle, jointly and broadly rounded at the apex which is produced downwards, the posterior declivity not very steep (about  $45^{\circ}$ ); dorsum only slightly convex longitudinally, highest at a little behind the middle, with fairly regular rows of separate foveolæ, the septa between them not granulate and about as wide as the narrow irregular intervals, which bear no large tubercles but only rows of irregular remote granules; the basal margin slightly raised but without any elevation on interval 3. *Legs* with shallow separated squamigerous punctures; femora with a small sharp tooth; tibiæ strongly curved and without any inner dilatation.

*Length* 7.5–8.0 mm., *breadth* 2.4–2.5 mm.

BORNEO: W. Sarawak, Mt. Matang, 3 ♂, xii. 1913, ii. 1914 (*G. E. Bryant*).

The nearest ally of this species is *E. pendleburyi*, sp. n., from which it differs in its much more slender form and the absence of tubercles on the elytra; the forehead is wider, the gular sinuation shallower, the pronotum lacks the irregular depressions, and the declivity of the elytra is much less steep.

#### Genus PINACOPUS Mshl.

This wingless genus, remarkable for its broad, non-bilobate third joint of the tarsi, was described in 1932 (*Ann. & Mag. N. H.* (10) ix. p. 348, fig. 3) for three Malayan species. Since then four more species have been received; two from Malaya, one from Siam, and one from Assam; the last is included here in order to give a complete conspectus of the available species of the genus. Actually, yet another species is known from Borneo (Mt. Penrissen, Sarawak), but the two specimens are in too poor condition for description.

#### *Key to the Species of Pinacopus.*

- 1 (6). Elytra with apical processes.
- 2 (5). Joint 2 of funicle longer than 1; elytra and legs with long stout erect setæ; rostrum of ♂ with rows of denticles.

- 3 (4). Apical processes of elytra comparatively long (1 mm.) and very sharp; front tibiae of ♂ with a fringe of long hairs; apical edge of elytra produced downwards in ♀ ..... *caudatus* Muhl.
- 4 (3). Apical processes of elytra less than half as long and very obtuse; front tibiae of ♂ without a fringe; apical edge of elytra not produced downwards in ♀ ..... *productus*, sp. n.
- 5 (2). Joint 2 of funicle not longer than 1; elytra and legs with smaller recumbent setae; rostrum of ♂ with narrow non-denticulate carinae ..... *caudatus*, sp. n.
- 6 (1). Elytra without any trace of apical process.
- 7 (10). Joint 2 of funicle much longer than 1; ♂ with rostrum denticulate and front tibiae with a fringe of very long setae.
- 8 (9). Elytra with narrow striae containing small punctures that are much narrower than the intervals and almost entirely concealed by dense scales, which are uniformly grey; ♂ with front tibiae not angulate internally and with erect setae in middle of pronotum ..... *dentirostris* Muhl.
- 9 (8). Elytra with rows of large punctures which are as wide as the intervals and not concealed by the comparatively sparse scales, which form a vague pattern of pale buff and brown; ♂ with front tibiae angulate internally, setae on pronotum all appressed ..... *foveolatus*, sp. n.
- 10 (7). Joint 2 of funicle not longer than 1; ♂ with rostrum not denticulate and front tibiae without a fringe of long setae.
- 11 (12). Front femora with a long sharp tooth; rostrum with fine carinae; setae on upper surface narrow; elytra with uniform grey scaling; ♂ with a broad median depression on ventrites 1 and 2 and a small tubercle on each side of it on ventrite 1 ..... *dolomus* Muhl.
- 12 (11). Front femora with a small obtuse tooth; rostrum irregularly punctate, without carinae; setae scale-like, very broad, almost circular; elytra with light brown and blackish markings; ♂ with the median ventral depression confined to ventrite 1 and without any tubercles. *nishimonensis*, sp. n.

*Pinacopus productus*, sp. n.

♂♀. Derm dull black, densely clothed above with uniform round grey scales, often covered with an earthy incrustation, and with sparse narrow scales on the underside.

*Rostrum* of ♂ slender, as long as the pronotum, sub-cylindrical, only slightly widening at the apex, with a fine low median carina that becomes obsolete on the basal third and two lateral carinae which unite at one-third from the apex, the inner one bearing low denticulations with a single much larger tooth close to the apex, the spaces between the carinae with large reticulate punctures; rostrum of ♀ somewhat longer, with the carinae flattened and without denticulations. *Antennae* with joint 2 of the funicle longer than 1. *Prothorax* a little longer than broad, moderately rounded laterally, widest at or slightly behind the middle, feebly constricted at base and near apex, with a transverse sulcus close to the base, the whole prothorax sloping downwards from apex to base when in a normal position of rest; dorsum slightly convex longitudinally, with close small subreticulate punctures, each filled with a scale, without any median carina, and with short sparse recumbent setae. *Elytra* elongate-ovate, shallowly sinuate jointly at the base, each with a short obtuse process just above the actual apex, which is not produced downwards in ♀, these processes subcontiguous, the basal margin somewhat raised, with a shallow transverse impression adjoining it; the shallow striae containing rather deep separated punctures, which are, however, more or less concealed by scaling and an earthy incrustation; the intervals with a row of flattened granules, each bearing a stout erect seta (often abraded). *Legs* with sparse elongate scales and long flattened sub-erect setae; femora with a short sharp tooth, tibiae with a distinct mucro in both sexes, the front pair without any fringe of long setae in ♂ but distinctly angulate internally.

*Length* 9.5–12.0 mm., breadth 3.2–4.3 mm.

FEDERATED MALAY STATES: Bukit Kutu, 3000–3460 ft., 2 ♂, 3 ♀, iv. 1915 (type), 2 ♂, ix. 1932 (*H. M. Pendlebury*); Selangor-Pahang, The Gap, 2700 ft., 1 ♀, i. 1915; Pahang, Fraser's Hill, 4200 ft., vii. 1931 (*H. M. P.*).

*Pinacopus caudulus*, sp. n.

♂♀. Derm dull black, with uniform subcontiguous round grey scales above, and sparse narrow scales beneath.

*Rostrum* of ♂ slender, as long as the pronotum, sub-cylindrical, somewhat widened at the apex, with five fine complete carinæ, the outer ones uniting behind the antennæ, without any denticulations, the interspaces with a row of shallow confluent punctures; rostrum of ♀ a little longer and more slender, with the carinæ flattened. *Antennæ* with joints 1 and 2 of the funicle equal. *Prothorax* sloping downwards from apex to base, slightly longer than broad, moderately rounded laterally, widest at about the middle, slightly constricted at base but not at apex; dorsum gently convex longitudinally, with dense small subreticulate punctures, each filled with a round scale, leaving the intervals bare, without any median carina, with sparse flat recumbent setæ. *Elytra* elongate-ovate, shallowly sinuate jointly at the base, which is somewhat raised, with a shallow transverse impression just behind it, the apices separately produced into a short pointed process involving the actual apical margin, which is not produced downwards in ♀; the shallow striæ and punctures entirely concealed dorsally by the dense scaling, the intervals with a row of small distant granules, each bearing a short subrecumbent flat pale seta. *Legs* with sparse recumbent setæ; femora with a short sharp tooth, tibiæ with a distinct mucro in both sexes, front pair without any fringe of long setæ in ♂ and not angulate internally.

*Length* 8.0–8.5 mm., breadth 2.7–3.0 mm.

FEDERATED MALAY STATES: Pahang, Cameron Highlands, Tanom Rata, 5000 ft., 1 ♀, vi. 1923 (*H. M. Pendlebury*); Berinchang, 5000–6000 ft., 1 ♂, 1 ♀, v. 1939 (*H. M. P.*—type).

*Pinucopus foveolatus*, sp. n.

♂. Derm dull piceous; prothorax with almost uniform, more or less isolated, large round pale brown scales, which are much larger than those on the elytra; the latter with mostly cream-coloured scales on the basal half, a very indefinite common oblong brown patch in the middle extending laterally to stria 4, an ill-defined dentate pale band across the top of the declivity, the latter being brown except for a few pale scales at the apex; the

brown scales mostly isolated, the pale ones closer together ; underside with very sparse pale scales.

*Rostrum* as long as the prothorax, subcylindrical, slightly widened at the apex, without any median carina, the two lateral ones uniting as usual near the antennæ, the inner ones rather sharply denticulate and ending in a larger tooth close to the apex, the interspaces with shallow subconfluent punctures. *Antennæ* with joint 2 of the funicle distinctly longer than 1. *Prothorax* slightly longer than broad, rather strongly rounded laterally, widest behind the middle, constricted at the base and shallowly so at the apex, with a transverse sulcus adjoining the base ; dorsum strongly convex longitudinally, highest at the middle, with large separated punctures filled by a round scale leaving the intervals bare, except for a few lanceolate recumbent scale-like setæ, without any median carina. *Elytra* oblong-ovate, almost parallel-sided from base to middle, shallowly sinuate jointly at the base, broadly rounded behind, without any apical processes ; dorsal outline moderately convex, highest behind the middle, and more steeply declivous apically than in the other species, the basal margin elevated, with a shallow transverse impression adjoining it ; hardly striate, with rows of very large round punctures, each containing a scale as large as those on the intervals : the latter not wider than the punctures, rather uneven, with a row of small granules bearing a short oblong subrecumbent seta. *Legs* with fairly dense round pale scales and oblong recumbent setæ ; femora with a short sharp tooth ; front tibiæ of ♂ with a fringe of long curved setæ and a strong mucro, the inner edge sharply angulate, hind tibiæ without any mucro.

*Length* 9.5 mm., breadth 3.5 mm.

PENINSULAR SIAM : Nakon Bri Tamarat, Khao Ram, 1200-3000 ft., 1 ♂, iii. 1922 (*H. M. Pendlebury*).

*Pinacopus mishmensis*, sp. n.

♂♀. Derm dull black ; prothorax with dark brown scaling and on each side a variable ill-defined broad stripe of light brown scales ; elytra with dense blackish scales, a very irregular broad band of light brown scales

on the basal third, including a small black patch at the base of intervals 3 and 4, an ill-defined light brown band across the top of the declivity, and some pale scales at the apex; underside with rather numerous broad light brown scales.

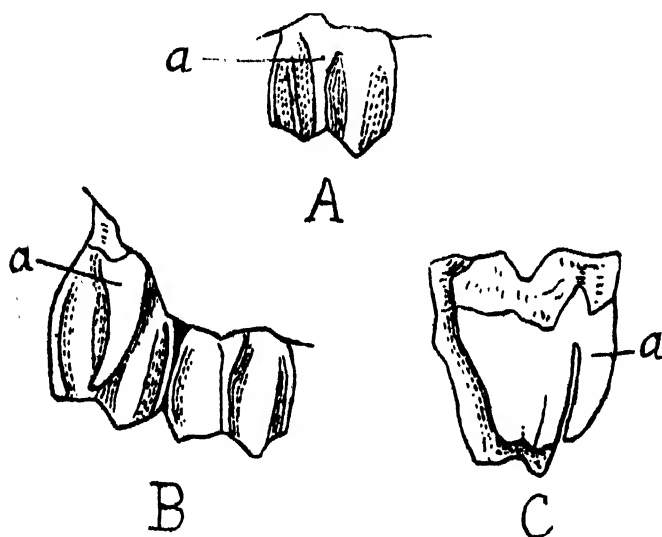
*Rostrum* as long as the pronotum in both sexes, sub-cylindrical, somewhat widened at the apex, the extreme apical margin honey-brown, with dense subreticulate punctation, which is rather coarser and more rugose in ♂, without any carinae or denticles. *Antennae* honey-brown, with joints 1 and 2 of the funicle equal. *Prothorax* a little longer than broad, moderately rounded laterally, widest beyond the middle, constricted at the apex but not at the base; dorsum strongly convex longitudinally, highest behind the middle, with large reticulate punctures, each containing a scale, and very large scale-like dark and pale setae, the pale scales in the lateral stripes larger than the dark ones elsewhere; no median carina. *Elytra* elongate-ovate, shallowly sinuate jointly at the base, obtusely acuminate behind, without any apical processes; dorsal outline moderately convex, highest at the middle, not steeply declivous behind, the base not transversely impressed and the margin not raised; hardly striate dorsally, with rows of large deep separated round punctures, which are partly concealed by the dense scaling; intervals not wider than the punctures, rather uneven, with a row of small shiny granules, each bearing a very broad, almost circular, erect, scale-like seta, concolorous with the area on which it stands. *Legs* with dense black and grey scaling, femora black on the basal two-thirds and grey apically, tibiae black on basal third or half; femora with a small obtuse tooth; front tibiae of ♂ without any fringe or angulation, and with only a small mucro, there being no mucro on the posterior pairs.

*Length* 6.0–6.5 mm., *breadth* 2.5 mm.

INDIA: Assam, Mishmi Hills, Delai Valley, Taphlogam, 7000 ft., 1 ♂, xi. 1936; Talon, 7000–10,000 ft., 1 ♀, xi. 1936 (*Miss M. Steele*).

XXXI.—*The Abnormal Last Molar in the Sambar of the Bonin Islands.* By R. I. Pocock, F.R.S., Department of Zoology, British Museum (Natural History).

THIS Sambar, introduced according to Aoki into the Bonin Islands, was described as *Cervus (Rusa) unicolor boninensis* by Lydekker (Ann. & Mag. Nat. Hist. (7) xv.



A. External surface of last upper molar of the right side of the Luzon Sambar (*Rusa unicolor marianna*).

a. The submedian ridge of the size and shape normal for the genus.

B. External surface of the last two upper molars of the right side of the ♂ of the Bonin Island Sambar (*Rusa boninensis*), with the hinder part of the socket of the last cut away to show the root of the tooth.

a. The abnormally-shaped, canine-like submedian ridge on the last or third molar.

C. Posterior surface of the same molar extracted from the jaw, showing the separation of the external ridge or accessory column (a) from the main part of the crown.

All figures natural size.



p. 392, 1905). The type is an adult ♀, represented by the skin and skull, and collected by P. A. Holst. Lydekker published a few particulars about the skull, but did not refer to the abnormality in its dentition, namely the complete loss of the last upper molar. The skull is fully adult and has the three premolars of the second set in place and a little worn, the first on both sides being twisted out of the usual position; also, the first two molars are in place and worn, but of the third, which should be in use before the premolars of the first set are shed, there is no trace even in the normal-sized area of the maxilla behind the molars, in this case the second.

Lydekker also referred to a second skull in the Tring Museum. This was transferred by Lord Rothschild to the British Museum in 1907, and bears the Register No. 7.8.6.1.; but Lydekker did not apparently examine it for entry and description in his Catalogue, published in 1915, thus missing the chance of noting the peculiar structural abnormality in its last upper molar.

The skull is that of a young ♂ with the three premolars of the first set much worn and on the point of being shed; the first two molars are somewhat worn, whereas the third is unworn, although nearly fully erupted. Its structural abnormality consists in the presence near the middle of the outer surface of a high, subcylindrical accessory column, with a pointed free end and rising from the roots of the tooth concealed in the jaw. This column, present on both sides, is not fused to the crown of the tooth, being separated therefrom by a narrow space. Its general shape recalls the canine tooth of some Carnivore, and it replaces and represents the normal submedian ridge found on the outer surface of the last molar in skulls of other Cervidæ.

# THE ANNALS AND MAGAZINE OF NATURAL HISTORY

[ELEVENTH SERIES.]

No. 54. JUNE 1942.

XXXII.—*On Two Species of Hepatics of the Yorkshire Jurassic Flora.* By TOM M. HARRIS, University of Reading.

THALLOID plant remains are rare in the plant-bearing series of the Yorkshire Oolites, but a few specimens have been briefly described under the names *Fucoides* or *Marchantites*. The present specimens were collected by Messrs. W. N. Edwards and F. M. Wonnacott in the Middle Estuarine (Bajocian) plant bed of Cayton Bay and form part of the collection of the Geological Department of the British Museum. One of the species was previously known, the other is new, and both on microscopic investigation provided clear evidence of affinity with the Hepaticæ.

Genus HEPATICITES Walton.

1925. *Hepaticites* Walton, p. 555.

*Nomenclature.*—It is proposed to follow the procedure put forward for thalloid fossils by Walton (1925, 1928):—

1. The form-genus *Thallites* Walton is to be used for thalloid fossils showing no character proving that they belong to the Hepaticæ rather than to the Algæ.

2. The form-genus *Hepaticites* Walton is used for thalloid fossils showing some definite character of the Hepaticæ. In practice this is usually the rhizoids.

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3. The genus *Marchantites* Brongniart (1849, pp. 12, 115) is restricted to hepatics agreeing with *M. sezannensis*, the type-species, in which marchantiaceous air chambers, ventral scales and reproductive organs have been demonstrated.

The genus *Palæohepatica* Raciborski (1894) and most of the species described under the name *Marchantites* should be referred to *Thallites*, though it is anticipated that reinvestigation would show that some of them would be correctly placed in *Hepaticites* Walton. The number of species of *Hepaticites* is as yet so small that no convenience would be served by subdividing it; it is, indeed, doubtful whether our knowledge is sufficient to warrant this course.

*Hepaticites arcuatus* (L. & H.), n. comb. (Fig. 1.)

1837. *Fucoides arcuatus* Lindley and Hutton, pl. 185.

1864. *Fucoides arcuatus* L. and H., Leckenby, p. 76.

1864. *Fucoides erectus* Leckenby, p. 81, pl. xi. figs. 2 a, b (3 a and 3 b in text).

1875. *Fucoides erectus* Leck., Phillips, p. 196; lign. 3.

1898. *Marchantites erectus* (Leck.) Seward, p. 233, fig. 49.

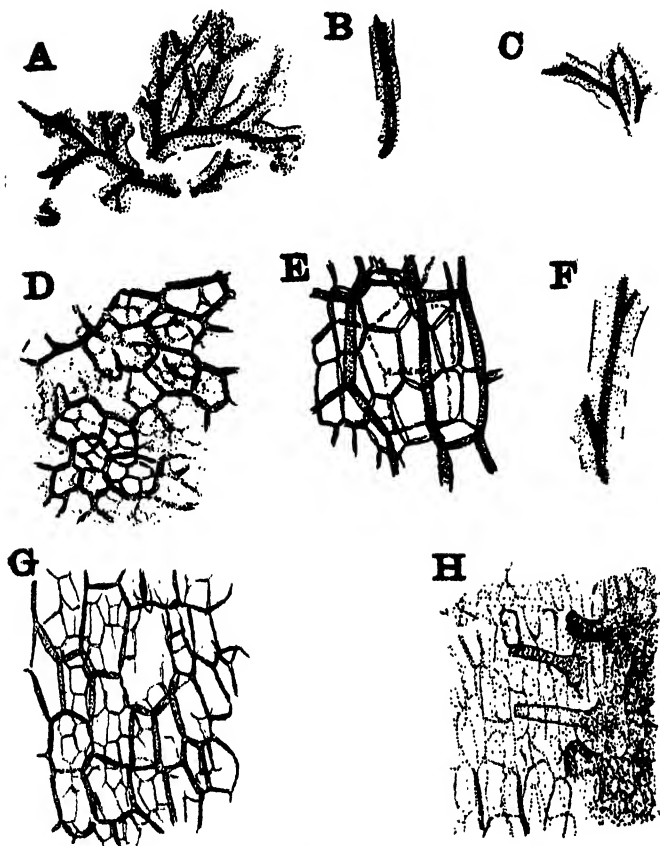
1900. *Marchantites erectus* (Leck.) Seward, p. 49, text-fig. 2; pl. xix. fig. 2.

1925. *Thallites erectus* (Leck.) Walton, p. 564.

Probably not *Fucoides arcuatus* of Phillips, 1875, p. 195, lign. 1. A few further citations of references to this species in the older literature will be found in Seward, 1900, p. 49.

*Emended Diagnosis*.—Plant thalloid. Thallus flat except at extreme margin, which may be curved downwards, margins almost entire. Branching by equal dichotomy, branches equal, usually divergent. Width of thallus typically 3–4 mm.; distance between successive dichotomies typically 5 mm. Lamina composed of about three layers of cells, of which a set about 80  $\mu$  wide (? lower epidermis) and a set about 40  $\mu$  wide (? upper epidermis) are fairly conspicuous; but another set of more delicate cells of intermediate size (? internal) is inconspicuous. Cells elongated over the midrib, becoming more isodiametric near the margin. Midrib composed of several layers of elongated, rather thick-walled cells; margins of midrib rather sharply marked. Small unicellular rhizoids borne in small numbers on the midrib. Ventral scales absent, reproductive organs unknown.

Fig. 1.



*Hepaticites arcuatus.*

A, largest available thallus. The fragments were probably continuous, but isolated by the loss of some of the rock surface. The delicate substance has been oxidized away and lost near the apices. V.25848,  $\times 1$ . B, slender fragment, V.24683,  $\times 1$ . The transfers shown in D, E, G, H were made from a fragment of this block. C, slender fragment with wavy margin, V.26832,  $\times 1$ . D, lamina in transfer,  $\times 100$ . E, semi-diagrammatic drawing of well-preserved lamina in transfer, showing three sets of cells,  $\times 200$ . F, widest thallus fragment, V.24683,  $\times 1$ . G, lamina in transfer, cells elongated,  $\times 100$ . H, margin of midrib, showing rhizoids, transfer preparation,  $\times 100$ .

*H. arcuatus* is represented by a number of fragments on a single bedding plane and by a few larger specimens which occur singly. The preservation is by no means perfect, the substance having adhered partly to one and partly to the other face of the split specimen; but in favourable regions the cellular structure can be seen by reflected light after moistening the surface with paraffin, and more clearly in transfers. In many cases almost the entire organic substance has disappeared after preservation.

Air chambers are undoubtedly absent in this species, and no ventral or other scales were seen. Rhizoids are rare, but those that occur are typical in being unicellular and unbranched. They show no tuberculate thickenings. These rhizoids and the dorsiventral structure of the lamina show that this plant is a hepatic and not a *Fucus*-like alga.

*Comparison*.—Although none of the previous accounts mentions the microscopic structure of *H. arcuatus*, there is no reason to doubt the identity of the series of specimens cited above, which seem to agree in general aspect and in their locality. It is probable that Phillips' *Fucoides arcuatus* is a distinct species with a broader thallus. A fragment of such a thallus does indeed occur in the present collection; its microscopic structure is distinct from that of *H. arcuatus* as described here, but description is for the present withheld. *Fucoides diffusus* Phillips (1875, p. 106), if correctly interpreted, differs in having a lobed margin. *H. wonnacotti* is compared below.

Among species from other regions, the most similar are :—

*H. laevis* Harris (1931, p. 5), in which rhizoids are more numerous and the cellular structure of the lamina is slightly different.

*H. amauros* Harris (1937, p. 6), which has a thicker lamina.

*H. solenotus* Harris (1938, p. 65), which has a channelled midrib and more rhizoids.

The most similar species of *Thallites* (of similar aspect but unknown structure) are :—

*Thallites yabei* (Kryshtofovich), n. comb. (formerly named *Marchantites yabei*: see Kryshtofovich, 1930, p. 144; 1933, p. 127; Oishi, 1940, p. 183), a slightly larger plant.

*Thallites uralensis* Kryshtofovich and Prinada, 1933, p. 7, a similar Liasso-Rhætic plant.

*Thallites zeilleri* (Seward), n. comb. (formerly known as *Marchantites zeilleri* Seward, 1894, p. 18), a Wealden plant of similar aspect.

*Thallites rostafinskii* (Raciborski), n. comb. (formerly known as *Palæohepatica rostafinskii* Raciborski, 1894, p. 10). This is a larger plant; Raciborski's figure of the surface shows a cellular texture which has been supposed to represent marchantiaceous air chambers, but which may more probably belong to true cells like those visible in *H. arcuatus*.

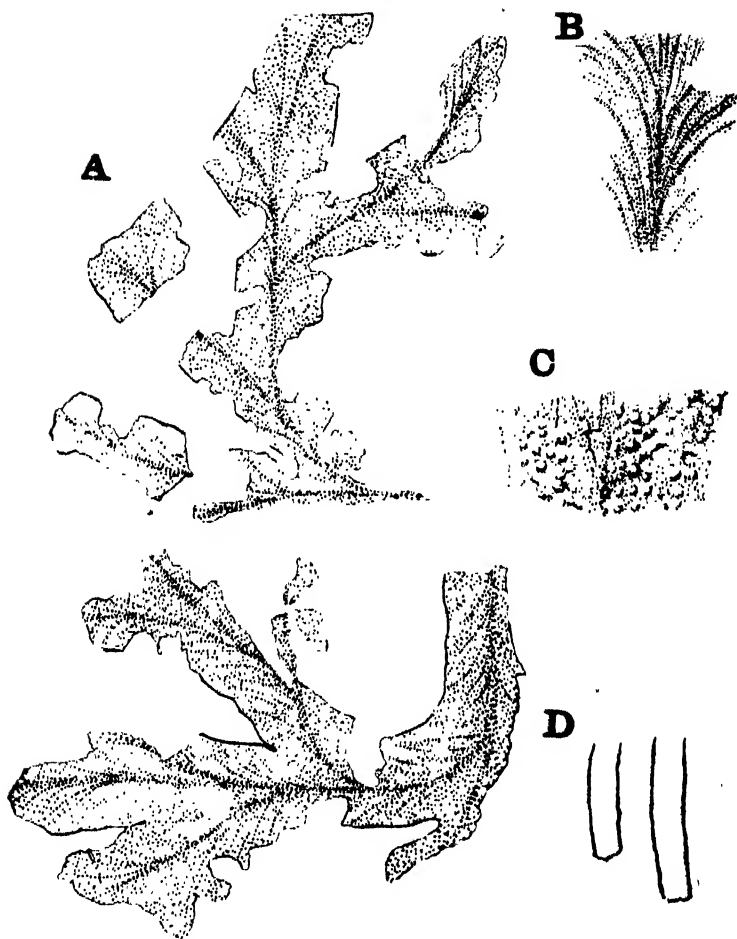
*Hepaticites wonnacotti*, sp. n. (Fig. 2.)

*Diagnosis.*—Plant thalloid; thallus about 12 mm. broad; dichotomizing at intervals of 1.5–2 cm. Thallus flat, apart from numerous low bulging areas about 1 mm. wide in the lamina. Lamina composed of several layers of cells which are polygonal and thin-walled over most of the lamina but elongated and thicker walled along the midrib. Midrib present but ill-defined, rib-like strands arising from the midrib and traversing the lamina. Long unicellular rhizoids 40  $\mu$  wide produced in considerable numbers along the midrib.

*Description.*—*H. wonnacotti* is represented by a number of fragments (or perhaps parts of a single specimen) on a single bedding plane of one hand-specimen. Most of the material is shown in fig. 2, A. It proved an unsatisfactory species to investigate, and it has features suggestive of morphological interest but of by no means clear interpretation. This uncertainty is largely due to poor preservation. The specimens seem to have been excellent when preserved, but their organic substance has largely disappeared. This has happened completely in parts which were originally delicate, and thus the margins are seldom seen, but where visible are entire, and no apices at all are seen. Transfers were obtained from the midribs and lamina which showed cellular structure, but these again were very imperfect. Even the midrib is translucent.

Although the surface-bulges are very low and obscure, there is no doubt that they are present in the lamina and not produced by the matrix: associated fossils, including *H. arcuatus*, show none. The bulges occur in rows parallel with the ribs of the lamina; they are not seen when the

Fig. 2.

*Hepaticites wonnacotti*, all from V.26833.

A, Thallus fragments. It is possible that the two large pieces join, but the rock is missing there. The margins appear jagged because of the bad preservation of their delicate substance,  $\times 1$ . B, apical region of thallus drawn under xylol, showing the ribs of the lamina,  $\times 4$ . C, older portion of the thallus after coating with  $\text{NH}_4\text{Cl}$ , showing the surface-bulges,  $\times 2$ . D, fragments of two rhizoids dissected away from the midrib during the preparation of a transfer,  $\times 100$ .

surface of the fossil is moistened, nor in the very imperfect transfer preparations, but are conspicuous after covering the surface with  $\text{NH}_4\text{Cl}$ .

These surface-bulges may be mere corrugations of the thallus or they may be air chambers like those of *Conocephalum* or *Marchantia*; such air chambers might conceivably impress their form on the matrix before the thallus softened and was compressed to an evenly thick film. No supporting evidence was, however, obtained, neither the cellular outline of air chambers nor air pores being recognized. This may be due to poor preservation; but in view of the rather large size of the possible air chambers a fairly large pore would have been expected, one big enough to be seen even in the present material. This is a matter which could probably be settled with better material.

The ribs of the lamina which arise alongside the midrib and bend outwards are readily seen in transfers and specimens moistened with oil as dark lines, but they do not form surface ridges. They are more conspicuous and also more numerous in the younger parts. They are composed of elongated cells  $10\ \mu$  broad, with rather thick walls.

Similar ribs are common in the Marchantiales, particularly in forms with strongly developed and persistent ventral scales which are attached along the ribs; and often, too, the ribs are supplemented by tuberculate rhizoids.

The present material was carefully examined both for ventral scales and for tuberculate or other specialized rhizoids. No ventral scales were seen, and it can be stated that if they occur at all they are not very persistent. No evidence of tuberculate rhizoids was seen along the ribs or other parts of the thallus, and it is certain that such rhizoids do not compose the ribs of the lamina, though the possibility is not finally excluded that some might supplement the ribs. The undoubted rhizoids which project from the midrib, and which were in some cases successfully dissected away and mounted separately, have evenly thickened walls.

*Comparison.*—*H. wonnacotti* is a larger plant than the other hepatic-like fossils of the Mesozoic, and is dis-



tinguished from them all by its surface-bulges and by the ribs of the lamina.

*Classification.*—Both *H. arcuatus* and *H. wonnacotti* are certainly members of the Hepaticæ, as is shown by the existence in each of typical rhizoids in the region of the midrib. Among recent genera, *H. arcuatus* resembles *Pellia* in form and *Aneura* in the poor development of rhizoids. As far as our present knowledge admits of classification of such material, it should therefore be placed in the Jungermanniales anacrogynæ.

It is noteworthy that nearly all the described species of *Hepaticites* resemble members of the Jungermanniales anacrogynæ: thus all four Palæozoic species described by Walton seem to belong here, and so do the five species previously described from various stages in the Mesozoic by Harris. The majority of these are purely thalloid, but some show lobed margins and some highly developed leaves.

The classification of *H. wonnacotti* is more doubtful because the essential facts are uncertain. If the surface-bulges represent air chambers, then it must be placed in the Marchantiales, of which group it would be perhaps the only Mesozoic representative (the position of *Thallites rostafinskii* being still more doubtful). Two other features suggesting marchantialean affinity are its dimensions (normal for the Marchantiales, very unusual for the Jungermanniales) and the ribs of the lamina. Similar ribs are of frequent occurrence in the Marchantiales, where they give origin to ventral scales and may carry tuberculate rhizoid strands; no jungermannialean liverwort seems to show such ribs, though the plates borne (on the upper side), in *Petallophyllum* might be compared. If, then, it is to be placed in the Jungermanniales it would constitute a quite exceptional member.

*Occurrence.*—Two points about the occurrence in Yorkshire of *Hepaticites* spp. seem worthy of note:

(1) Some large specimens appear to have been undamaged at the time of preservation. (Their poor appearance is due to their very delicate substance suffering subsequent changes). This suggests that the plants grew near where preserved, and were not carried far by water.

(2) Although they are an uncommon element of the flora, they dominate certain bedding planes where both

species are associated. This suggests that they were common enough where they grew, but were seldom carried to the places of deposition and sedimentation.

It is possible to picture them as growing as ground cover among vegetation well clear of the water. However abundant they were they would normally rot where they grew, and their only chance of being preserved would be when they were rapidly buried by flood deposits.

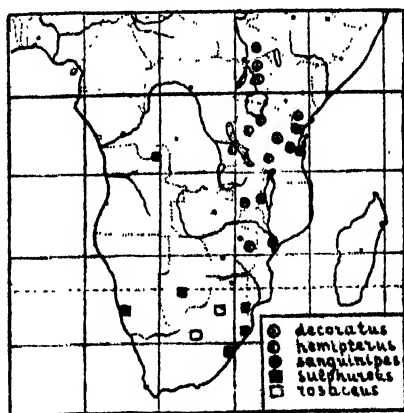
I wish to thank the Keeper of the Department of Geology, Mr. W. N. Edwards, for help with the manuscript of this paper.

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**XXXIII.—A Preliminary Revision of the decoratus-Group of the Genus *Catantops* Schaum, 1853 (Orthoptera, Acrididae). By B. P. UVAROV, D.Sc., British Museum (Natural History).**

THE specific classification of *Catantops* presents great difficulties owing to a very large number of known species, many of which are imperfectly described. My extensive studies in this genus suggest that several well-defined generic units are comprised, but more work is necessary for a complete revision. It is already possible,



Distribution of the subpecies of *Catantops decoratus* Gerstaecker, 1869.

however, to give the results of critical studies of certain assemblages of species, which may be, for the time being, regarded as groups within the genus.

The *decoratus*-group is one of the most easily recognized, as all its species are characterized by moderate size but robust habitus, brightly coloured hind wings, and very smooth and shiny sides of pronotum and pleurae, decorated with a broad oblique dark fascia, which is flanked by two narrow light ones.

*Key to Species and Subspecies of the decoratus-Group.*

- 1 (2). Externomedian area of the hind femur with two large dark spots, one in the middle extending from the median line down to the lower margin, and another in the apical part ..... 1. *signatus*.
- 2 (1). Externomedian area variously marked, but not with two large spots.
- 3 (4). Externomedian area uniformly dark reddish-brown, with a sharply defined narrow ivory-white stripe along the lower edge. Wings orange. 2. *neumannii*.
- 4 (3). Externomedian area not as in the preceding species.
- 5 (18). Wings more or less yellow (or orange).
- 6 (7). Hind tibia and inner face of femur very bright sanguineous-red; the latter blackened in more than upper apical half; its upper inner surface with a single black spot; lower inner sulcus bright red, sharply separated by yellowish carina from the shiny-black lower outer sulcus; externomedian area with a rather large submedian black spot not reaching the lower margin. Front and middle femora and tibiae heavily marked with black on the posterior surfaces. General pattern and coloration as in other members of the group, but all colours very bright and very sharply contrasting. Total length, ♂ 22, ♀ 20; pronotum, ♂ 5, ♀ 6; elytra, ♂ 21, ♀ 24; hind femur, ♂ 13.5, ♀ 16.5 mm. S. Sudan: Loka, 1. iv. 1932, 2 ♂♂ (including the type), 1 ♀; Mongalla, Kofira, 2. iv. 1932, 6 ♂♂, 8 ♀♀; Uganda: Amar, Gulu, 29. xi. 1931, 1 ♂ (*H. B. Johnston*); N. Belgian Congo: Aru, iii. 1936, 1 ♀ (*H. Bredo*) ..... 3. *johnstoni*, sp. n.
- 7 (6). Hind tibia and inner face of femur testaceous-yellow, or very pale sanguineous-reddish.
- 8 (13). Inner face of hind femur with three separate black spots.
- 9 (12). Inner face of hind femur and hind tibia testaceous-yellow.
- 10 (11). Elytra and wings fully developed, exceeding hind knees in both sexes.
- 11 (10). Elytra and wings abbreviated, not reaching the hind knees ..... 4a. *decoratus decoratus*.
- 12 (9). Inner face of hind femur and hind tibia pale sanguineous. Elytra and wings fully developed ..... 4b. *decoratus*  
[*hemipterus*].
- 4c. *decoratus sanguineus*, subsp. n.

- 13 (8). At least the median and the preapical black spots on the inner face of hind femur are connected by a black stripe.
- 14 (17). Inner face of hind femur with the basal spot very small, or absent; median spot not extending to the upper inner sulcus, and connected with the preapical spot by a black stripe (sometimes partly interrupted). Tibia and femur inside testaceous-yellowish, or pale dirty-sanguineous. Externomedian area of the femur with a diffused dark streak in the upper part of the apical half (sometimes absent).
- 15 (16). Wings dark yellow. Elytra extending slightly beyond hind knees ..... 5. *femoratus*.
- 16 (15). Wings orange. Elytra extending well beyond hind knees ..... 5 a. *femoratus*  
[*aurantius*, subsp. n.]
- 17 (14). Inner face of hind femur mostly black, all three spots being large and fused; median spot extending to the upper inner sulcus. Tibia and femur inside testaceous-yellow. Externomedian area with a median black dot (sometimes small or absent). Wings dark yellow ..... 4 d. *decoratus*  
[*sulphureus*.]
- 18 (5). Wings light rose. Legs as in the preceding subspecies ..... 4 c. *decoratus*  
[*rosaceus*, subsp. n.]

*Annotated List of Species and Subspecies of the  
decoratus Group.*

1. *C. SIGNATUS* Karsch, 1891. Togo, N.E. Congo.

1891. *Catantops signatus* Karsch, Berlin Ent. Ztschr. xxxvi. p. 190.

1923. *Catantops bokoensis* Sjöstedt, Ark. Zool. xv. no. 22, p. 17.

1929. *Catantops signatus* Sjöstedt, i. c. xx. A, no. 15, p. 30.

The above synonymy was established by Sjöstedt himself in 1929. The species is known to me from Bambesa, Uélé district, Belgian Congo.

2. *C. NEUMANNI* Ramme, 1929. Tanga-Mombasa lowlands.

1299. *Catantops neumanni* Ramme, Mitt. zool. Mus. Berlin, Bd. xv. p. 435, fig. 89.

A very remarkably coloured species, described from a single female collected at Tanga, and known to me from 1 ♂ and 2 ♀♀ taken at Rabai, near Mombasa.

3. *C. JOHNSTONI*, sp. n. Southern Sudan, N. Uganda.

A very strikingly coloured species described above in the key, which I am very pleased to name after its discoverer, Mr. H. B. Johnston, well known for his thorough investigations of the ecology of locusts and of Acrididae generally in Eastern Africa.

4a. *C. DECORATUS DECORATUS* Gerstaecker, 1869. Uganda to Southern Rhodesia.

1869. *Catantops decoratus* Gerstaecker, Arch. Naturgesch. xxxv. p. 219.

1873. *Catantops decoratus* Gerstaecker in von der Decken, Reise Ostaf., Ins. p. 44, pl. 7, fig. 4.

1900. *Catantops solitarius* Karsch, Ent. Nachr. xxvi. p. 280 (syn. nov.).

1900. *Catantops decoratus* Karsch, l. c. p. 280.

1901. *Catantops solitarius* Krauss, Verh. zool.-bot. Ges. Wien, li. p. 289 (partim).

1907. *Catantops decoratus* Karny, Sitzber. Ak. Wiss. Wien, mat.-nat. Kl. cxvi. pp. 312, 328 (partim).

1907. *Catantops solitarius* Karny, l. c. p. 347, pl. ii. figs. 34-38 (partim).

The character in which *C. solitarius* differs from *C. decoratus* is the presence on the externomedian area of hind femur of a single black median dot. A study of any long series of specimens from a single locality shows that this character is subject to individual variation, and it is possible to find specimens with a dot present on one femur and absent on the other. Therefore, no taxonomic value can be attached to this single character, and *solitarius* Karsch should be regarded as a pure synonym of *decoratus* Grt. On the other hand, *C. sulphureus* Walker, which I synonymised in 1925 with *solitarius* (Trans. Ent. Soc. London, 1925, p. 295) and which has been confused with the latter by Krauss and Karny, is well distinct in the pattern of the inner side of hind femur and should be regarded at least as a good subspecies.

The distribution of the present subspecies is apparently fairly wide, although in discussing it no reliance can be placed on the old records owing to the confusion with *sulphureus* and possibly with other subspecies. *C. decoratus decoratus* is definitely known to me from several localities in Uganda; from Kibwezi and Narosura river in Kenya; Pare "desert" in N.E. Tanganyika; Masilewa, Kondoa province, Tanganyika; Mashonaland, Gazaland and Selukwe in S. Rhodesia; Mlanje and Fort

Johnston, Nyasaland ; Luano Valley, N. Rhodesia ; Busi River, Portuguese East Africa ; and Kanga in Angola (see map).

4 b. *C. DECORATUS HEMIPTERUS* Miller, 1929. W. Tanganyika Territory.

1929. *Catantops hemipterus* Miller, Trans. Ent. Soc. London, 1929, p. 87, pl. ix. fig. 43.

1929. *Catantops hemipterus* f. *macroptera* Ramme, Mitt. Zool. Mus. Berlin, xxix. p. 435 (syn. nov.).

I have before me a long series of specimens from Shinyanga, Tanganyika Territory. The length of elytra is somewhat variable, but even in the most long-winged individuals they do not quite reach the knee. The type of f. *macroptera* Ramme, from the Rukwa Lake in S.W. Tanganyika Territory, does not differ in this respect from some of the Shinyanga specimens, but is more robust and more brightly coloured ; it may represent a minor local modification, not deserving a subspecific name. The median dot on the externomedian area is usually, but not always, absent ; in *macroptera* it is distinct. Originally described from Kalula (40 miles S. of Tabora), this subspecies seems to be distributed in the west of Tanganyika Territory, extending into Congo (Albertville, Ramme, 1929).

4 c. *C. DECORATUS SANGUINIPES*, subsp. n. E. Tanganyika Territory.

1929. *Catantops sulphureus* Miller, Trans. Ent. Soc. London, 1929, p. 87 (nec Walker).

A very long series of both sexes collected by Mr. N. C. E. Miller in several localities of Eastern Tanganyika Territory consists of specimens with the inside of hind femur and the hind tibia coloured pale sanguineous, while in all other characters the specimens do not differ from the typical *C. decoratus decoratus*. The sanguineous coloration of the legs cannot be considered in this case a seasonal phenomenon, because the specimens taken in various months of the year do not exhibit any variation in this respect. I see, therefore, no choice but to regard this series as representing a subspecies characterized by the leg coloration and restricted to the eastern part of the Tanganyika Territory, from Dar-es-Salaam to Dodoma.

The type is a male from Kilosa, April 1927; and the paratypical series includes 166 specimens of both sexes from Dar-es-Salaam, Kilosa, Tindiga, Mkalama, Dodoma, and Tubugwe (*N. C. E. Miller*); two female paratypes are from Morogoro (*E. Burt*).

Two females from Kilosa and two from Tubugwe have the leg coloration as in *C. decoratus decoratus* and they are included amongst the paratypes. I am inclined to regard them as individual variations in the direction of the typical form.

4 d. *C. DECORATUS SULPHUREUS* (Walker, 1870). S. Africa.

1870. *Caloptenus sulphureus* Walker, Cat. Derm. Salt. Brit. Mus. iv. p. 695.

1901. *Catantops solitarius* Krauss, Verh. zool.-bot. Ges. Wien, li. p. 289 (*nec* Karsch).

1925. *Catantops sulphureus* Uvarov, Trans. Ent. Soc. London (1924), p. 295.

In 1925 I regarded *C. sulphureus* as a pure synonym of *C. solitarius* Karsch (= *decoratus* Grst.), but recent studies of longer series of both insects convinced me that the differences in the pattern of the inner side of hind femur are correlated with geographical distribution, and should be considered of subspecific value. Krauss (*loc. cit.*) has given a very good description of *sulphureus*, although he has included in his series some unquestionable *decoratus* as well.

My reasons for assigning to *sulphureus* only a subspecific status are the apparent mutual exclusion of that subspecies and *decoratus*, and also the fact that in two females from the Kruger National Park, Transvaal, the median and pre-apical spot of hind femora are separated, though the median is fused with the basal.

As regards the distribution of *sulphureus*, it is definitely known to occur in Natal (type locality), Pondoland, Zululand, Bechuanaland, and S.W. Africa.

4 e. *C. DECORATUS ROSACEUS*, subsp. n. Transvaal.

Specimens of *C. decoratus* from the high veldt of Transvaal and Orange Free State are exactly like *C. decoratus sulphureus*, but have the wings light rose in colour, and I regard them tentatively as representing a distinct subspecies.



The type is a female from Pretoria, 28. xii. 1918 (*Ch. Brain*); and the paratypes, as follows:—Marico, Transvaal, Jan. 1918, 1 ♀; Witwatersberg. Johannesburg, Transvaal, 2. v. 1938, 1 ♀ (*E. Burt*); Bloemfontein, Orange Free State, 10. iii. 1918, 1 ♀.

5. *C. FEMORATUS* Ramme, 1929. Tanga, Amani.

1929. *Catantops sulphureus* f. *femorata* Ramme, Mitt. zool. Mus. Berlin, xix. p. 435.

1929. *Catantops sulphureus* f. *tibialis* Ramme, l. c. p. 435 (*syn. nov.*).

Ramme has established his f. *femorata* only on the presence of a dark pre-apical streak on the externo-median area of the hind femur, but the pattern of its inner face is also very distinct from that in *C. decoratus* (which he has called *sulphureus*, accepting the incorrect synonymy suggested by me in 1925: see above, p. 407). I have now before me all types as well as a good series of this insect collected by Mr. E. Burt at Tanga and Sigi, near Amani, and the pattern of the inner side of hind femur appears to be sufficiently constant and different from that in *decoratus* to be considered of specific value. At the same time the series exhibits a variation in the general colour of hind tibia and of the inside of hind femur, which are either pale dirty sanguineous or dirty yellowish. There is no correlation in the coloration either with the distribution or with seasons, and I consider its variation as a purely individual phenomenon. Accordingly, f. *tibialis* of Ramme, which is based only on the reddish colour of the tibia, has to be regarded as an individual form of the species.

It should be added that the two specimens, Ramme's type and paratype of *tibialis*, are not from Tanga, but from Tana, 9. ii. 1894 (*Stuhlmann*).

5 a. *C. FEMORATUS AURANTIUS*, subsp. n. Tanga.

There is in the collection of Mr. E. Burt a female with long elytra and orange wings which I am inclined to regard as a distinct subspecies, not only because of its strikingly different appearance, but also on account of its distribution. Mr. E. Burt has collected at Tanga and in the neighbouring localities and obtained a good series of typical *femoratus*, except on one occasion when he found the present striking form at the edge of the

mangrove swamp. According to him several more were observed but not captured. It would appear, therefore, that *aurantius* represents a form of the species closely associated with the coastal mangrove zone.

The female type was taken on 9. vi. 1937, on the road along the edge of mangrove swamp north of Tanga (*E. Burt*).

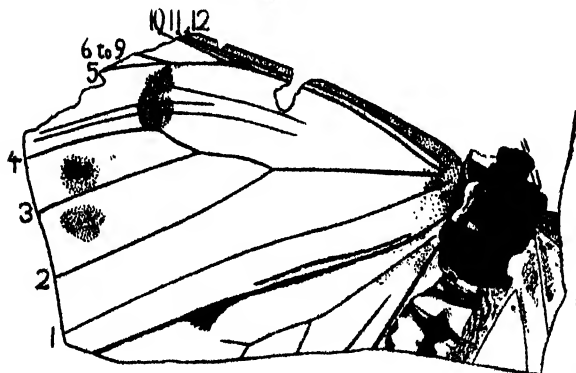
#### XXXIV.—Two new Fossil Butterflies of the Family Pieridæ.

By FREDERICK E. ZEUNER, British Museum (Natural History).

##### (1) *Miopieris talboti*, gen. et sp. n.

*Diagnosis*.—A Pierid related to *Pontia* and *Synchloe*, with vein 5 of the fore wing connate with the common stem of veins 6 to 9, veins 10 and 11 arising from the cell, distant from its upper angle, with a broad cell, and

Fig. 1.



*Miopieris talboti*, gen. et sp. n., from the upper Miocene of Randecker Maar, south-west Germany. 3 times natural size. The veins, shown in black, are white in the specimen. A few minute patches of foreign matter are omitted.

a lower discocellular at right angles to the axis of the cell, slightly angled, so that its concave side is facing towards the base of the wing. White, with a discocellular black spot slightly extended anteriorly towards the base of the

wing, and with two round postdiscal spots in the spaces between veins 2 and 3 and 3 and 4.

*Distribution*.—Sarmatian, Upper Miocene: Randecker Maar, Swabia, south-west Germany.

*Holotype*.—L. Armbruster leg. 1928. Deposited in the British Museum (Natural History).

*Parts known*.—Head, thorax and anterior half of the abdomen, left fore wing (apex missing), portion of left hind wing and a small portion of right hind wing, all seen from the upperside. Counterpart, with traces of the body and wings. Scaling preserved, shape of the black scales recognizable.

*Measurements*.—Thorax, length 5.1 mm., width 3.9 mm. Cell of fore wing, length 14.3 mm., max. width 4.2 mm. Estimated length of fore wing 22 mm., width from tornus to costal margin about 16 mm.

*Description*.—The body does not exhibit features of systematic value, except that in proportions it agrees well with Recent Pieridæ related to *Pieris*. Hairs are not preserved, and palpi and antennæ are missing.

Fore wing: apex and outer margin not preserved. Cell relatively very wide. Superficially resembling a Recent *Pieris* Schrank, but differing in the arrangement of the black spots and in the venation.

Veins 10 and 11 arising from the cell, close together, the distance between 10 and the upper angle of the cell measuring about 3 mm. Veins 6+7+8+9 on a common stalk from the cell, this stalk connate with vein 5. The lower *dc* is nearly straight, though noticeably angled near its middle, the angle being open towards the base of the wing. This is a very unusual character. Lower *dc* about 3 mm. long, measured in a straight line.

The connate origin of 5 and 6+7+8+9 permits of concluding that, in the missing part of the apex, 6 was stalked on the radial stem. This, in turn, renders it probable that 7, 8 and 9 were not present individually, but at least one of them missing, or fused with one of the others.

The fore wing is white, the scaling being dense and chalky. The black markings are thinly scaled, interspersed with white. A black oval spot covers the entire lower *dc* and extends, with a few black scales, anteriorly towards the base, joining the blackish costal margin.

Two postdiscal circular black spots are present between 2 and 3 and 3 and 4. The upper of these spots is a little proximal of the other, which condition is typical of many Pieridæ. The base of the fore wing is powdered black.

Hind wing: fore portion covered by the fore wing. Hind portion missing from half-way down the anal margin across to the tornus of the fore wing (along this line the rock-slab is broken off). In the middle portion, veins 2 and 3, and their common stem, can be seen. As far as preserved, the hind wing is plain white, with its base slightly dusted black.

*Remarks.*—The new species is dedicated to Mr. G. Talbot, who, in the course of the investigation of the two fossils described in this paper, has, in a most unselfish manner, placed at my disposal his profound knowledge of the Recent Pieridæ.

The latest generic revision of the Pieridæ is by Klots (1933). Since he considers fully the venational features of all genera and gives keys which can be applied in determining the systematic position of the fossil, I use his classification in the present context. It must be admitted, however, that his tribes of the Pierinæ are not beyond criticism. The Rhodocerini are, probably, worthy of being regarded as a subfamily (Coliadinæ) as done by Talbot (1935), and the distinction of the Euchloini and Pierini is obscured by many overlaps, if characters other than the male genitalia are considered.

Of the subfamilies distinguished by Klots (Pseudopontiinæ, Dismorphiinæ, Pierinæ), the first is ruled out by having a stalked vein 5, as well as by many other venational characters. The Dismorphiinæ are ruled out by the presence in this subfamily of a long middle *dc*, vein 5 arising from the cell.

The fossil, therefore, can only be placed in the Pierinæ, on the grounds of its venation. The shape of the fore wing and, in particular, of the cell, and the pattern and colour, lend strong support to this conclusion.

Klots's three tribes of the Pierinæ, the Euchloini, Rhodocerini and Pierini are distinguished chiefly on characters of the male genitalia, antennæ and palpi, which are not preserved in the fossil. The venation alone is not sufficient to exclude the fossil from any one of these tribes as a whole, but an individual comparison

with the genera comprising the Euchloini and Rhodocerini shows that each of them differs from the fossil in essential features. Furthermore, pattern and coloration of the fossil exclude all the Rhodocerini as well as nearly all the Euchloini (except certain *Euchloe* Hübner). This argument is, of course, less convincing than that based on the venation.

Considering the genera of the Pierini as defined by Klots in his key, all three alternatives of his group (1), i. e. with veins 7 to 11 all present, or one, or two, of them missing, have to be tried, since the apex of the fossil is not preserved. The fact, however, that vein 5 is connate with the stalk of  $6+7+8+9$  renders it highly probable that one or two of the veins  $7+8+9$  were absent.

In the group with "three radials" (two veins missing), one arrives at *Phulia* Herrich-Schäffer or *Leptosia* Hübner. In *Phulia*, however, vein 5 is stalked and the cell is narrow. In *Leptosia*, veins 10 and 11 are wide apart (close together in the fossil), and the discoidal vein is clearly concave towards the apex. This, as well as the pattern of *Leptosia*, which has never more than a single post-discal spot, and its thin white scaling (unlike the chalky scaling of the fossil), exclude the fossil from this genus also.

From the group with "five radials" (7 to 11 all present) the fossil is excluded by its vein 5 being connate with the stalk of  $6+7+8+9$ , which character does not occur in this group of Klots's.

There remains the group with "four radials," the largest division of Klots's key. Here, the following possible alternative are obtained: *Saletara* Distant, *Piercolias* Grote, *Appias* Hübner, *Prioneris* Wallace. In *Saletara*, *Appias* and *Prioneris*, vein 5 arises from the discocellular vein, and there are many other differences excluding the fossil from these genera.

In the only available species of *Piercolias* Grote (syn. *Andina* Staudinger, *Trifurcula* Staudinger), *P. huanaco* Staudinger from Bolivia, vein 5 is said to be connate with the stem of  $6+7+8+9$ . There is some variation in this character. Of 10 specimens of the British Museum collection, vein 5 is connate in five, arises from the discocellular in four, and is stalked with 6 to 9 in one specimen. More reliable venational characters are provided

by vein 10, which arises from the upper angle of the cell, and by the exceptional width of the space between veins 1 and 2. In these two characters the fossil differs from *Piercolias*.

It is evident, therefore, that the fossil is distinct from any known Recent genus, and the question arises as to which of the existing genera it shows affinity or, at least, resemblance. The fossil, *Miopieris talboti*, gen. et sp. n., is characterized by the combination of the following characters: Vein 5 connate with stalk of  $6+7+8+9$ , veins 10 and 11 close together, arising from the cell, distant from its upper angle. Cell broad, lower *dc* at right angles to the axis of the cell and slightly angled, with the concavity towards the base of the wing. Discocellular spot oval and fairly large, extended anteriorly towards the base. Costal margin and base of wing dusted black. Postdiscal row of spots starting between veins 2 and 3; at least two spots present, possibly more in the apex; no evidence of a spot between veins 4 and 5, but this spot in Recent forms often displaced towards the margin. White scaling dense and chalky.

This combination of characters is approached by certain genera closely related to *Pieris* Schrank, such as *Pontia* Fabricius, *Synchlœ* Hübner, and *Tatochila* Butler. In these, vein 5 is fairly close to the stem of  $6+7+8+9$ , though never connate with it. The lower discocellular is often fairly straight, but always slightly concave towards the apex (concave towards the base in *Miopieris*). The closest approach to the fossil is, perhaps, observed in *Pontia callidice* Esper. The pattern of the fossil also fits into this group, and specimens with a very similar distribution of black on white are found, for instance, among the males of *Tatochila macrodice* Staudinger. This comparison is not intended to mean that *Miopieris* is most closely related to the South American *Tatochila*, but that it belongs to the group of genera enumerated above. Klotz regards *Tatochila* as derived from *Synchlœ*, which, in turn, is considered as a subgenus of *Pieris*. Rôber (1908) also regards *Tatochila* as closely allied to *Pieris*, and Schatz (1892) as a subgenus of *Pieris*.

The South American genera *Phulia* and *Piercolias*, and the Palearctic *Baltia* Moore, in which vein 5 has moved up to the base of  $6+7+8+9$ , or even become stalked,

are specialized branches of the same *Synchlœ*-group according to Grote (1900), Röber (1908) and Klots (1933). In these three genera the middle discocellular has disappeared, as it has in *Miopieris*, but other specializations remove the fossil from these three genera farther than from *Synchlœ* or *Pontia*. Thus one appears justified in considering *Miopieris* as a genus closely related to the *Synchlœ*-group of the Pierini.

*Phylogenetic considerations.*—Although *Miopieris talboti*, gen. et sp. n., comes from a deposit of the upper Miocene, the age of which, according to the radioactivity time-scale, is estimated at 15 to 20 million years, it cannot in any respect be regarded as more primitive than the Recent genera of Pieridæ. The same applies to many other groups of insects. Generally speaking, the evolution of insects since the upper Miocene has been confined to the formation of genera and species, and on the whole the evolutionary level has not risen to such an extent that the upper Miocene representatives of modern groups have to be considered as more primitive\*. Thus the only phylogenetic conclusion to be derived from the discovery of *Miopieris* is that the Pierini existed in the upper Miocene.

Other fossil Pieridæ, supposed or genuine, are :

*Coliates proserpina* Scudder, Lower Oligocene : Aix-en-Provence, France.

*Mylothrites pluto* (Heer) Scudder, Lower Miocene : Radoboj, Croatia.

*Pierites freyeri* Heer, Lower Miocene : Radoboj, Croatia.

*Stolopsyche libytheoides* Scudder, Miocene : Florissant, Colorado, U.S.A.

*Belenois crawshayi* Butler, Pleistocene or post-Pleistocene : East Africa.

Since it is my intention in the near future to revise the fossil Lepidoptera, it may suffice here to say that *Mylothrites* is a Nymphaline, *Coliates* possibly a Pierid (it has some venational features in common with *Delias* and *Prioneris*), and *Pierites* and *Stolopsyche* are too poorly

\* As is to be expected, there are exceptions to this rule, as, for instance, in the honey-bees (*Apis* Linn.).

preserved for determining the family. *Belenois crawshayi* is described below (2).

It is evident that *Miopieris* cannot be identified with any fossil Pierid previously described.

*Notes on the deposit.*—The Randecker Maar is the crater of a small volcano which was formed during the Sarmatian phase of the upper Miocene and is, therefore, contemporary with the famous localities of Böttingen and Oeningen, which have yielded large numbers of fossil insects. All these localities lie on the great plateau of Jurassic limestone known as the Swabian Alb.

Soon after its formation, the crater of the Randecker Maar became filled with water, and a mud rich in organic matter was deposited in the newly formed lake. At the present day it appears as an extremely finely laminated greenish or blackish shale. Its high content of organic matter has suggested to investigators the possibility of extracting mineral oil; it burns in the hot flame, but its exploitation has never been considered worth while. Fossils have been known from this deposit, which is called a dysodil or paper-coal by petrologists, for nearly a hundred years, but nothing had ever been described until L. Armbruster carried out excavations there in 1928 (Armbruster, 1929; Zeuner, 1932).

(2) *Belenois crawshayi* Butler.

1925. *Belenois* Hübn., Handlirsch, Handb. Ent. iii. p. 273.

*Distribution.*—Fossil, Pleistocene or post-Pleistocene: East African Copal. Recent: Nyassaland to Kenya, Angola, south Congo to Kivu.

*Fossil specimen.*—British Museum (Natural History), no. I.3004. Purchased of Miss Harford, April 1895.

*Parts preserved.*—Complete male specimen; only head missing.

*Description.*—The specimen is preserved with its wings in the position of down-stroke, but sufficient space is left for the undersides to be examined. In size, venation, pattern, coloration and the shape of the clasper it agrees entirely with the Recent East African *Belenois crawshayi* Butler. This species varies in the intensity of the black markings, but the fossil resembles the average males. The black pattern is preserved as a dull brownish grey,



owing to soaking with the resin, but all the elements of both upper- and underside can be identified.

*Remarks.*—This specimen was first determined by an unnamed worker and preserved in the British Museum under the correct name but, apparently, never recorded in print. As it was obtained in 1895, when A. G. Butler, an authority on Pieridæ, was still working at the Museum, it is probable that he identified it. Mr. G. Talbot and I have once more compared the specimen with Recent specimens, and convinced ourselves that the identification is correct.

Handlirsch knew the specimen; most probably he saw it on a visit to the British Museum.

There is nothing surprising in the occurrence of a Recent species of butterfly in the East African copal. This fossil resin is shipped from Zanzibar, which is usually given as the locality, but it comes from the mainland (for details of this deposit, see Zeuner, 1939, p. 31). The East African copal is of Pleistocene or even later age, or at most a few hundred thousand years old, a period during which only subspecific, if any, modifications are likely to have taken place.

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XXXV.—*The Relict Fauna of Ennerdale Water.*

By W. M. TATTERSALL, D.Sc., University College, Cardiff.

THE recent discovery of *Mysis relicta* in Ennerdale Water (Scourfield, 1941) raises once more the problem of the origin of the relict fauna of that lake. The problem has been discussed at length by Gurney (1923, 1928, and 1931) in connection with the occurrence of the relict Copepod, *Limnocalanus macrurus*, in Ennerdale. Gurney was unable to find a satisfactory geological explanation for the occurrence of a relict fauna in Ennerdale and sums up his conclusions as follows: "It seems quite clear that *L. macrurus* reached Ennerdale after the retreat of the glaciers, and its presence points to physical changes of which geologists find no evidence."

*Mysis relicta* is found in the Great Lakes of North America, Lough Neagh in Ireland, and in a large number of relict lakes in Scandinavia, Finland, North-West Russia, and North Germany. It is generally accepted that the relict lakes of North America, and, at least certain of the relict lakes of North-West Europe, have arisen from late-glacial seas which covered the regions in which they lie, in the case of North America from the Champlain Sea, and in the case of North-West Europe from the Yoldia Sea and its successor, the Ancylus Lake. It is supposed that the waters of these seas became detached from the larger masses of water by late glacial uplift of the land, leading to the emersion of the lake areas with their contained marine fauna, which gradually adapted itself to the increasing freshwater conditions and survives to-day as relict species.

There are, however, a number of relict lakes, more especially those of the northern strip of the German Plain, to which this explanation cannot apply, because during no part of late or post-glacial times were they ever covered by the sea or a marginal extension of the sea. To account for the relict fauna of the North German lakes, Hogbom (1917) put forward his "Stausee" theory. This theory contends that the Baltic Glacier, in its re-advance southwards and eastwards, pushed before it

the extra-glacial marine waters against and on to the rising ground south and east of the Baltic to form a series of saline, later by influx of land drainage, brackish marginal lakes, from which the relict fauna of the relict lakes was directly derived. Høgbom suggested that a similar explanation was applicable to Lough Neagh in Northern Ireland. Charlesworth (1928) adopted Høgbom's explanation for Lough Neagh, and showed that this lake had come under the influence of a re-advance of the Scottish ice from the sea, which converged on the coasts of North-East Ireland, impounded the normal drainage and formed a vast lake, the present Lough Neagh. The re-advancing ice pushed the marine waters and their contained fauna before it into this new lake, and *Mysis relicta* has survived to this day as a relict species.

My colleague, Dr. L. R. Moore, of the Geological Department of University College, Cardiff, has recently called my attention to a series of papers (Dixon, 1922; Smith and others, 1931; Smith, 1932) which appear to me to provide the necessary geological evidence which will account for the relict fauna of Ennerdale Water.

I cannot do better than quote at length the summary of the glacial phenomena in this area as given by Smith (Smith and others, 1931, pp. 8-9). It runs as follows:—  
“The history of the glaciation of the district can be interpreted in three episodes, of which the earliest is the least clear. Each comprised an advance and retreat of the ice that emanated from our hill country, from seaward or from both directions simultaneously. The second or ‘main’ glaciation, due to combined Lake District and Scottish ice, has left the most widespread records in its powerful erosive action, its ground moraines and drumlins, and retreat phenomena such as marginal or terminal moraines, glacier-lake deltas, eskers, kames, land-stream deltas and overflow channels. During the withdrawal of this ice glacier-lakes were impounded temporarily in the mouth of Ennerdale (discovered by Mr. Dixon, and the first example recognised in the Whitehaven-Workington district), in the Marron and Derwent valleys, in the Eden valley near Egremont and in the St. Bees-Whitehaven valley.

“Between the second and third episodes there was apparently an amelioration of climate, forming probably

a true Interglacial period, evidenced by deposits of seed-bearing peats discovered at St. Bees.

"The effects of the third glaciation, which consisted mainly of a re-advance of Scottish or Irish Sea ice on the coastline, are just as clearly marked in our area, but not so widespread as those of the second episode. We may note that the St. Bees-Whitehaven valley again held a glacier-lake and others were formed near Distington. *During the advance some sea-water was probably trapped and forced inland, perhaps as far as Ennerdale.*" (Italics mine.)

According to Dixon (1922) the glacier-lake Ennerdale was impounded to a height of 600 ft., and the level of the lake was raised to 800 ft. on the re-advance of the Irish Sea ice in the third episode of the glacial period. When the Irish Sea ice again retreated the lake level fell once more to 600 ft. Dixon points to a terminal moraine at the lower end of Ennerdale which was deposited by the Irish Sea ice on its re-advance. Ennerdale is, therefore, dammed by a terminal moraine which owes its origin to the Irish Sea ice. Dixon's map (1922, p. 120, fig. 5), shows the boundary of the 800 ft. glacier-lake Ennerdale as just crossing the western end of the present lake. It seems to me that Smith's suggestion, italicised in the above quotation, offers the necessary explanation of the occurrence of *Mysis relicta* in Ennerdale, and, conversely, the presence of *M. relicta* in Ennerdale offers confirmatory biological evidence of the truth of Smith's suggestion. It is not within the scope of this note to set out the geological evidence in detail. Reference to the papers in which this evidence is given must suffice. My purpose is merely to direct the attention of biologists to these papers as offering a reasonable explanation of the relict fauna of Ennerdale.

The problem still remains as to why Ennerdale Water alone apparently of the Lake District lakes has a relict fauna. I use the word apparently here advisedly, for it cannot be said that the remaining lakes of the Lake District (with the exception of Windermere) have been systematically and thoroughly investigated. The intensive work of the Freshwater Biological Association Laboratory at Wray Castle on the fauna of Windermere renders it almost certain that a relict fauna does not exist there.

It is important that the remaining lakes should be properly investigated for the possible existence of relict species in order that the biological evidence should be complete for correlation with the geological evidence. As to the latter, while I do not feel competent to appreciate it to the full, it does seem to me that there is a certain amount of evidence which suggests that Ennerdale Water alone of the existing lakes came into contact with water from the sea, and alone had the opportunity of acquiring a relict fauna.

From Smith's paper (1932) it would appear that during the main glaciation the whole of the Lake District was covered by a sheet of ice which advanced in a westerly direction over the foothills and lower ground of the Vale of Eden, the Carlisle Plain, and the West Cumberland foothills and lowlands. This sheet of Lake District ice was opposed by a sheet of ice, nourished in Scotland, which advanced southward and filled the Irish Sea basin. This sheet of ice, the Irish Sea ice, deflected the westward movement of the Lake District ice southwards and the two sheets became more or less united, though each ice sheet preserved its separate identity in general. When the main glaciation began to wane and both sheets of ice began to retreat, cleavage between them took place, commencing in the south. The tendency would be for the Irish Sea ice to shrink towards the sea basin westward and north-westward, and for the Lake District ice to shrink up the Lake District valleys north-eastwards and eastwards. The line of cleavage has been traced by Smith in this area, commencing at the Duddon Estuary and proceeding almost due north, to the west of Black Combe, across the lower end of the Esk valley, the Miter valley, Wasdale and Ennerdale, and northwards up the valley of the Marron River.

Smith (1932, pp. 62-63) sums up this phase of the glaciation as follows:—"Thus, the retreat of the ice as far north at least as Ennerdale seems to have taken place in a fairly orderly manner, . . . It tended, on the whole, to produce long sweeping curves in the flank of the Irish Sea ice, and to cause the Lake District ice to break up on its fringes into valley-glaciers or isolated corrie-glaciers, which parted company with the Irish Sea ice one after

the other in northward sequence. Glacier-lakes impounded between the Irish Sea ice and the snouts of the retiring valley-glaciers, were accompaniments of this sequence but did not form a contemporaneous series, no more than two of the larger ones being in existence at any one time."

The glacier lakes mentioned by Smith appear to have been formed in sequence from south to north as the two sheets of ice retreated. Commencing in the south with glacier-lake Duddon, other glacier-lakes were formed in the Whicham valley, Eskdale, Miterdale, Wasdale, and Ennerdale. North of Ennerdale glacier-lakes Pardsham and Cockermouth were formed in the valleys of the Marron and Cocker rivers. Smith points out that these glacier-lakes did not form a contemporaneous series, but, as the retreat of the two ice sheets continued and freed the valleys of the lakes completely from ice, the impounded glacier-lakes disappeared one by one. For instance, by the time that glacier-lake Ennerdale was formed the glacier-lakes of Eskdale and Wasdale had disappeared. These glacier-lakes drained away to the south and south-west at least until the ice sheet had retreated as far as the Marron valley. Here there is apparently some evidence that the glacier-lakes Pardsham and Cockermouth drained northward into the valleys of the Marron River and Derwent River and then westward to the open sea.

When glacier-lake Ennerdale was in existence there took place a re-advance of the Irish Sea ice sheet and the level of the glacier-lake was raised from 600 to 800 feet. At this level the glacier-lake Ennerdale reached the western end of the valley of the present lake, which was just beginning to emerge as the Ennerdale lobe of the Lake District ice sheet gradually retreated up the Ennerdale valley and the present day Lake Ennerdale began to form. The re-advance of the Irish Sea ice sheet took place in the third glacial episode, and it was during this re-advance that "some sea water was probably trapped and forced inland, perhaps as far as Ennerdale." (Smith, 1931.) This was the time when Ennerdale probably acquired its relict species. When the retreat of the Irish Sea ice was resumed and the valley of the glacier-lake Ennerdale gradually freed from ice, the glacier-lake

Ennerdale gradually drained away mainly to the south and west and disappeared, but some of its waters probably also drained into the new Ennerdale valley in process of formation, for, as noted above, the glacier-lake Ennerdale was in contact with the new valley when the level was at 800 feet. It is in this way, I take it, that the relict species were handed on, so to speak, from the glacier-lake to the present Lake Ennerdale, where they have survived. The changes here outlined are illustrated by Smith and others (1931, figs. 26-27).

As far as I can understand the geological evidence, none other of the present-day lakes came under the influence of the re-advancing Irish Sea ice sheet. Loweswater had begun to appear at the time when the re-advance of the Irish Sea ice sheet was at its maximum, but the Crummock Water valley was still icebound as indeed were all the other lake valleys to the eastward. According to the above-mentioned figures the Irish Sea ice re-advance stopped some distance short of Loweswater, and this lake was apparently unaffected by it. Wastwater, to the south and east of Ennerdale, was also probably in existence at this time, but the glacier-lake Wasdale had disappeared before glacier-lake Ennerdale was formed, and I can trace no evidence that glacier-lake Wasdale was ever in contact with the present Wastwater, as the glacier and present Ennerdale were. The other glacier-lakes have all disappeared, those to the north of Ennerdale, Lake Pardshaw and Lake Cockermouth, draining away to the westward into the Derwent valley as the ice sheets retreated.

If a contour map of the present Lake District is studied it would appear that, at the time of the 800 feet glacier-lake Ennerdale, the water could have overflowed into the Crummock and Bassenthwaite-Derwent valleys, and even into Thirlmere and Ullswater. Any flooding, however, into these valleys would have been effectively prevented by the wall of the Lake District ice sheet, and by the time this sheet had retreated sufficiently to expose these valleys glacier-lake Ennerdale had disappeared.

I submit, therefore, that the geological evidence as presented in the papers of Dixon (1922), Smith and others (1931), and Smith (1932), offers a reasonable explanation of the origin of the relict fauna of Ennerdale,

and I suggest that, on this same evidence, it is possible to explain why Ennerdale alone of the present lakes of the Lake District has acquired such a relict fauna.

This explanation does not involve any considerations of large scale elevations and submergences of the land such as would be necessary if Ennerdale was a true relict lake and owed its origin to causes similar to those which are held to account for the Great Lakes of Canada or the relict lakes of Sweden. Ennerdale is not a relict lake in any sense of the word. It has acquired a relict fauna, accidentally so to speak, as a result of its contact with glacier-lake Ennerdale, which in turn received impounded sea water and its contained fauna as a result of the re-advance of the Irish Sea ice. This explanation also provides yet another way in which a lake may have acquired a relict fauna. In fact, it suggests, as indeed might have been expected, that there is no royal road to the acquisition of a relict fauna, but that each case requires separate consideration in the light of the local conditions and local geological phenomena. In this case the geological and biological evidence, acquired independently and without the knowledge of the other, provide striking confirmatory evidence in each other's support.

I should like to express my grateful thanks to Dr. L. R. Moore, Dr. F. J. North, of the National Museum of Wales, and Dr. R. Gurney for valuable assistance with the literature of the subject and for helpful discussion and friendly criticism of the problems involved.

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**XXXVI.—New or little-known Tipulidæ (Diptera).—LXIV.**  
*Neotropical Species.* By CHARLES P. ALEXANDER,  
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THE species described herewith are all from Peru, where they were taken in the Departments of Ayacucho, Huanuco and Junin by Mr. Felix Woytkowski, and in Junin by Mr. Pedro Paprzycki. A discussion of the Junin stations has been given in earlier part under this title (Ann. & Mag. Nat. Hist. (8), xi, pp. 240-241, 1941). The crane-flies here considered all belong to the great tribe Eriopterini, unusually well represented in the Peruvian Andes. All types of new species are preserved in my collection of these flies.

*Neolimnophila andicola*, sp. n.

General coloration grey, the præscutum with four clearly delimited brown stripes; wings with a weak brown tinge, stigma oval, pale brown; vein  $R_2$  beyond form of  $R_{2+3+4}$ , a short element  $R_{2+3}$  being present;  $R_{2+3+4}$  rather strongly arcuated, exceeding  $R_3$ ; cell 1st  $M_2$  of moderate length; male hypopygium with the inner dististyle provided with conspicuous erect strong setæ; basistyle with the two spines strongly developed, not greatly dissimilar in shape or size.

*Male*.—Length about 6.5 mm.; wing 7.5 mm.

Rostrum grey; palpi black. Antennæ black throughout; fusion-segment long-conical, the last segment of the fusion indicated by a suture, the total fusion involving five segments with nine free segments beyond the fusion; verticils shorter than the segments. Head brownish grey.

Pronotum brownish grey. Mesonotum grey, the præscutum with four clearly delimited brown stripes

much as in *ultima*; posterior sclerites of notum dark grey. Pleura uniformly grey. Halteres with stem dirty white, knob weakly infuscated. Legs with the coxæ grey pruinose; trochanters brownish yellow; femora black, their bases obscure yellow, narrowest on fore legs, very extensive on posterior pair where only the distal sixth is blackened; remainder of legs black; tibial spurs present. Wings with a weak brown tinge, the prearcular and costal fields slightly more yellow; stigma oval, pale brown; veins brown, yellow in the brightened portions. Venation:  $R_2$  shortly beyond fork of  $R_{2+3+4}$ , so a short element  $R_{2+3}$  is present;  $R_{2+3+4}$  rather strongly arcuated, about three-fourths the length of  $R_3$ ; cell  $M_1$  subequal to its petiole;  $m-cu$  beyond one-third the length of cell 1st  $M_2$ . The distal position of  $R_2$  is more as in *appalachicola* than in *ultima*.

Abdomen, including hypopygium, black. Male hypopygium with the outer face of inner dististyle provided with long, coarse, erect setæ. Basistyle with both spines strong and conspicuous, the outer one fully four-fifths the length of inner and nearly as stout. In *ultima*, the setæ of the inner dististyle while being elongate are much more slender than in the present fly, while the spines of the basistyle are very unequal in size, the outer one being much reduced.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Yanamonte, La Mar, in fog forests, altitude 3000–4100 metres, September 30, 1941 (*Woytkowski*).

*Neolimnophila andicola* is quite distinct from the two Nearctic species of the genus so far described, *N. appalachicola* Alexander, of the south-eastern United States, and *N. ultima* (Osten Sacken), widespread over northern North America. The venation and structure of the male hypopygium readily separate the present fly from these allies. The discovery of a true *Neolimnophila* in South America is of considerable interest, since it constitutes the first record of the genus from south of the equator.

*Teucholabis (Paratropesa) fumidapicalis*, sp. n.

Allied to *fasciolaris*; head reddish; pronotum and pleura uniformly yellow; mesonotum black, the praescutum with two transverse yellow bands, the second at the suture; knobs of halteres yellow; fore femora black,

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the basal fourth yellow; middle and posterior femora yellow with narrow black tips; fore tibiae black; wings cream-yellow, heavily patterned with dark brown, the broad wing apex paler brown; abdominal tergites black; sternites black with the posterior halves obscure yellow.

*Female*.—Length about 5.5 mm.; wing 5.3 mm.

Rostrum reddish yellow; palpi black. Antennae with scape yellow; pedicel and flagellum black; flagellar segments oval, the verticils longer than the segments. Head reddish.

Pronotum uniformly yellow. Mesonotal præscutum with the ground-colour obscure yellow, conspicuously patterned with polished black, including a transverse girdle before suture and a disconnected median black area occupying the anterior third of sclerite; the yellow ground thus appears as two narrow transverse areas, the more anterior angulated, the posterior band at the suture more nearly straight; scutum yellow, each lobe with an extensive quadrate black area; scutellum and postnotum, involving both the mediotergite and pleurotergite, polished black. Pleura uniform orange-yellow, including the dorso-pleural membrane, the ventral sternopleurite a little more reddish. Halteres with stem blackened, knob yellow. Legs with all coxae and trochanters yellow; fore femora black, with a little more than the basal fourth yellow; fore tibiae brownish black, the tips, together with the tarsi, black; middle and posterior femora yellow with the tips narrowly but conspicuously blackened; tibiae obscure yellow, the extreme bases and the wider tips blackened; tarsi black. Wings (fig. 7) with the ground-colour cream-yellow, heavily patterned with dark brown, including all of cells *C* and *Sc*, with posterior extensions therefrom over the arculus and as a complete band across wing between origin of *Rs* and tip of vein 2nd *A*, widened in cells *M* and *Cu*; a second narrow but complete brown band extends from and includes the darker stigma, nearly parallel-sided, becoming paler and more diffuse in the cubital and anal cells; wing-tip distinctly infuscated but paler in colour than the remaining bands, its inner end lying at the forks of *R*<sub>3+4</sub> and *M*<sub>1+</sub>; veins yellow, conspicuously dark brown in the heavily patterned areas, more brownish yellow in the apical band. Venation: *Sc*<sub>1</sub> ending before mid-length of *Rs*, *Sc*<sub>2</sub> shortly beyond

origin of  $R_s$ ; vein  $R_3$  oblique, a little longer than  $R_2$ ; cell 1st  $M_2$  open by atrophy of basal section of  $M_3$ ;  $m-cu$  close to the fork of  $M$ .

Abdominal tergites black; sternites black with the posterior halves of the segments obscure yellow; genital segment yellow, blackened apically; cerci light yellow.

*Hab.* Peru (Junin).

*Holotype*, ♀, Satipo, Jauja, altitude 800–900 metres, June 29, 1940 (*Paprzycki*).

By my latest key to the Neotropical species of *Paratropesa* (Konowia, 12: 44–45; 1933), the present fly runs to *Teucholabis* (*Paratropesa*) *fasciolaris* (Wiedemann) and *T. (P.) lindneri* Alexander. In the darkened wing-tip it is closest to *fasciolaris*, differing especially in the coloration of the body and legs.

*Teucholabis* (*Teucholabis*) *salva*, sp. n.

Allied to *melanocephala*; general coloration obscure yellow, the præscutum with three chestnut-brown stripes; cervical region very long and slender; legs black, the femora with a yellow ring at near three-fourths the length; wings brownish yellow with a conspicuous but diffuse brown pattern; costal border darkened; cell 1st  $M_2$  closed; male hypopygium with the outer dististyle terminating in two approximated blackened points.

*Male*.—Length about 11.5 mm.; wing 8.5 mm.

*Female*.—Length about 11.5 mm.; wing 8 mm.

Rostrum brown; palpi black. Antennæ with scape brown, pedicel and flagellum black; basal flagellar segments oval, the succeeding ones passing through long-oval to elongate-cylindrical, the verticils conspicuous, exceeding the segments in length. Head polished black; anterior vertex about one-half wider than the diameter of scape.

Cervical region very long and slender, black. Pronotum brown above, paling to brownish yellow on sides. Mesonotum obscure yellow, polished, the præscutum with three more chestnut stripes, the median one darker in front; centres of scutal lobes similarly chestnut-brown. Pleura with propleura and mesepisternum brownish, the posterior sclerites and the pleurotergite obscure brownish yellow. Halteres dark brown, the knobs large. Legs

with the coxæ and trochanters obscure yellow; femora black, obscure yellow on basal portions; all femora with a yellow ring at about three-fourths the length, wide and diffuse on fore legs, narrow but distinct on the middle and hind legs; tibiæ and tarsi brownish black, the outer tarsal segments black; posterior basitarsi swollen at posterior end and provided with a longitudinal glandular area; claws simple. Wings with the ground-colour brownish yellow, conspicuously but diffusely patterned with brown, including the costal border and broader apex; additional washes at origin of *Rs*, along cord and outer end of cell 1st *M*<sub>2</sub>, and in the subbasal portions of cells *Cu*, 1st *A* and 2nd *A*; stigmal area darker brown; veins yellow, darker in the patterned areas. Posterior border of wing of male more or less in-shirred opposite termination of vein 2nd *A*; costal fringe very short and sparse. Venation: *Sc* long, *Sc*<sub>1</sub> ending beyond mid-length of *Rs*, *Sc*<sub>2</sub> far from its tip, closer to origin of *Rs* than to tip of *Sc*<sub>1</sub>; *Sc*<sub>2</sub>, *R*<sub>1</sub> before stigma unusually arcuated toward costa, widening cell *R*<sub>1</sub> at this point; *R*<sub>2</sub> more than one-half its length beyond fork of *M*; cell 1st *M*<sub>2</sub> shorter than any of the veins beyond it.

Abdomen, including hypopygium, brownish yellow; sternites somewhat clearer yellow; sternal pocket and armature of seventh sternite conspicuous. Male hypopygium (fig. 1) with apex of basistyle, *b*, obtusely rounded; spine on mesal face broadly dilated on basal half, thence rapidly narrowed into a straight black spine; surface of spine with microscopic appressed spinulæ; blackened flange at mesal edge of basistyle conspicuous, the margin irregularly serrate. Outer dististyle, *od*, a simple rod, at and before outer end with two spinous points; surface of style with abundant, unusually coarse setæ, the outer surface with microscopic appressed spinulæ. Inner dististyle, *id*, with the beak blackened, the outer lobe dark coloured, conically produced, provided with about six spinous setæ. Ædeagus with apex bilobed, each lobe microscopically serrulate at apex.

*Hab.* Peru (Huanuco, Junin).

*Holotype*, ♂, Pumahuasi, Huanuco, altitude 980 metres, July 23, 1939 (*Woytkowski*). *Allotype*, ♀, Satipo, Juaia, Junin, altitude 800–900 metres, October 25, 1940 (*Paprzycki*).

*Teucholabis* (*Teucholabis*) *salva* is most nearly allied to the species that centre around *melanocephala* (Fabricius), differing conspicuously in the very diffuse wing-pattern, the coloration of the legs, and in the structure of the male hypopygium. The members of the group that have cell 1st  $M_2$  closed, as in the present fly, include: *T. (T.) angustapicalis* Alexander, *T. (T.) catharinensis* Alexander, *T. (T.) inulta* Alexander, *T. (T.) melanocephala* (Fabricius), *T. (T.) oteroi* Alexander, and *T. (T.) perangusta* Alexander.

*Teucholabis* (*Teucholabis*) *bigladius*, sp. n.

General coloration polished black, including the entire mesothorax; halteres black; legs black, the fore femora yellow on basal third; fore and middle basitarsi obscure yellow, except at tips; wings whitish subhyaline with four dark brown cross-bands, all complete except the basal one at arculus which extends caudad to vein 1st  $A$ ;  $Sc_1$  ending just beyond mid-length of  $Rs$ ; male hypopygium with the basistyle produced at apex into two slender spines, the outermost from an elongate base; outer dististyle a weak simple rod with a series of microscopic serrations along outer margin.

*Male*.—Length about 6 mm.; wing 6.6 mm.

Rostrum and palpi black. Antennæ with basal segments black; flagellum broken. Head brownish black, polished.

Pronotum brownish black. Mesonotum polished black throughout. Pleura black, including the dorsopleural membrane. Halteres black. Legs with the coxæ black; trochanters brownish yellow; fore femora black with about the basal third yellow; remaining femora uniformly black; all tibiæ black; fore and middle basitarsi obscure yellow, the tips blackened; posterior basitarsi more infuscated; outer tarsal segments black; posterior basitarsi weakly dilated on basal third. Wings whitish subhyaline, with four dark brown cross-bands, the first at arculus, extending only to vein 1st  $A$ ; other dark bands completely traversing the wing, the second at and beyond origin of  $Rs$  nearly parallel-sided; third band a little narrower, strongly constricted opposite fork of  $M$ ; fourth band including the broad apex, its inner margin nearly straight and embracing the outer end of cell 1st  $M_2$ ; cell  $Sc$  uniformly darkened; veins pale brown,

a little darker in the clouded areas. Venation :  $Sc_1$  ending just beyond mid-length of  $R_s$ ,  $Sc_2$  a short distance from its tip ;  $R_2$  just beyond fork of  $R_s$  ; branches of  $R_s$  long and approximately parallel to one another for their entire length ; cell 1st  $M_2$  long, gently widened outwardly, a little longer than vein  $M_3$  beyond it ;  $m-cu$  more than one-half its length beyond the fork of  $M$ .

Abdomen, including hypopygium, polished black. Male hypopygium (fig. 2) with the basistyle,  $b$ , produced at apex into two slender spines, the outermost from a long strong basal enlargement that is provided with microscopic

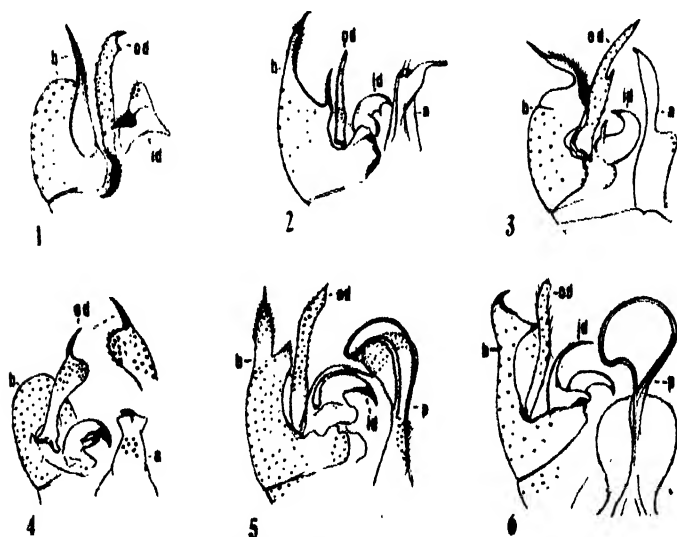


Fig. 1.—*Teucholabis (Teucholabis) salva*, sp. n. ; male hypopygium.  
 Fig. 2.—*Teucholabis (Teucholabis) bigladius*, sp. n. ; male hypopygium.  
 Fig. 3.—*Teucholabis (Teucholabis) luteicolor*, sp. n. ; male hypopygium.  
 Fig. 4.—*Teucholabis (Teucholabis) subjocosa*, sp. n. ; male hypopygium.  
 Fig. 5.—*Teucholabis (Teucholabis) inepta*, sp. n. ; male hypopygium.  
 Fig. 6.—*Teucholabis (Teucholabis) idiophallus*, sp. n. ; male hypopygium.

(Symbols :  $a$ , aedeagus ;  $b$ , basistyle ;  $id$ , inner dististyle ;  $od$ , outer dististyle ;  $p$ , phallosome.)

setulae ; mesal face of style produced into a blackened lobe ; setae of unusual length and strength, mostly on basal half ; in addition to the setae, the surface with dense erect setulae. Outer dististyle,  $od$ , an unusually slender rod, the surface with a few very long scattered setae, the outer margin with a series of microscopic serrations over

the distal half of the length ; basal third of style more dilated. Inner dististyle, *id.*, with two acute teeth ; outer margin of style with about six long strong setæ. *Ædeagus*, *a.*, as figured, the apex slender, deflected strongly laterad.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Aflador, altitude 670 metres, May 21, 1937 (*Woytkowski*).

*Teucholabis* (*Teucholabis*) *bigladius* is readily told from the rather numerous polished black species in the Neotropical fauna that have heavily patterned wings by the presence of a fourth incomplete dark band near the wing-base, and, especially, by the structure of the male hypopygium. The only other species known to me with the basistyle bispinous is the otherwise entirely distinct *T. (T.) biramosa* Alexander, of Ecuador.

*Teucholabis* (*Teucholabis*) *luteicolor*, sp. n.

General coloration reddish yellow, the thorax unmarked except for a single blackened median area on cephalic fourth of præscutum ; head dark brownish grey ; knobs of halteres darkened ; legs yellow, the tips of femora conspicuously blackened, the amount subequal on all legs ; wings pale yellow, variegated only by the unusually small, pale brown stigma ; *Sc*<sub>1</sub> ending about opposite two-thirds the length of *Rs* ; abdomen reddish yellow, unpatterned ; male hypopygium with the apex of basistyle a flattened glabrous plate that is further produced into a strong curved arm that terminates in a slender blackened spine, the mesal edge of the arm with a fringe of long delicate setæ ; outer dististyle bearing a lateral spine or tooth at near mid-length ; inner dististyle with a single spinous point ; *ædeagus* with the narrowed apical half in longitudinal alignment with the base.

*Male*.—Length about 6–6.5 mm. ; wing 5.5–6 mm.

Rostrum yellow ; palpi black. Antennæ black throughout ; flagellar segments oval. Head dark brownish grey.

Thoracic notum reddish yellow, the præscutum with a single black median area on the cephalic fourth, representing the anterior end of the normal median præscutal stripe ; median area of scutum a little clearer yellow. Pleura uniform reddish yellow, unmarked. Halteres with stem yellow, knob darkened. Legs with the coxæ and trochanters yellow ; femora yellow, the tips rather narrowly but conspicuously blackened, including about



the distal sixth or seventh, the amount subequal on all legs; tibiae obscure yellow, the tips narrowly darkened; tarsi black. Wings relatively broad, pale yellow, variegated only by the unusually small, oval, pale brown stigma; veins pale brown, those of the prearcular and costal fields yellow. Venation:  $Sc_1$  ending about opposite two-thirds the length of  $Rs$ ,  $Sc_2$  a short distance from its tip;  $m-cu$  shortly beyond fork of  $M$ .

Abdomen reddish yellow, the sternal pockets of male darkened. Male hypopygium (fig. 3) with the apex of basistyle,  $b$ , a flattened glabrous plate that is further produced into a strong curved arm that terminates in a slender blackened spine, the whole structure somewhat resembling the head of a heron-like bird; mesal edge of plate and arm with a row of long conspicuous setae. Outer dististyle,  $od$ , a long straight rod, at near mid-length bearing a small blackened spine or tooth, the apex of style terminating in a small acute point; setae of style extending to extreme apex; outer surface with numerous appressed spinulae. Inner dististyle,  $id$ , with a single acute blackened point, the lower point being obtuse. Aedeagus,  $a$ , with the narrowed apical half in direct longitudinal alignment with the dilated base, terminating in a small darkened point; setae of aedeagus pale and very few in number.

*Hab.* Peru (Huanoco); Ecuador (Oriente).

*Holotype*, ♂, Afilador, Peru, altitude 670 metres, June 15, 1937 (Woytkowski). *Paratopotype*, ♂, June 16, 1937; *paratype*, ♂, Rio Huagra Yacu, Ecuador, altitude 900 metres, March 31, 1941 (Macintyre).

*Teucholabis* (*Teucholabis*) *luteicolor* is very distinct from all known species. In its general appearance it is most like *T. (T.) jocosa* Alexander, wide-spread in Tropical America, but the structure of the male hypopygium is entirely different in the two species.

*Teucholabis* (*Teucholabis*) *subjocosa*, sp. n.

Allied to *jocosa*; thoracic pleura very heavily striped longitudinally with black; abdominal segments dimidiate, dark brown basally, the apices broadly yellow; male hypopygium with the outer dististyle a strong club, the outer angle abruptly narrowed into a strong black spine, the bulge of the club with numerous appressed spinulae.

*Male*.—Length about 5.5 mm.; wing 5.5 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval, the verticils exceeding the segments. Head dark grey.

Pronotum reddish yellow above, darkened laterally. Pretergites pale yellow. Mesonotum reddish, the median cephalic portion of præscutum and circular sublateral spots before the suture intense black; a similar black spot on lateral portion of each scutal lobe; scutellum clear light yellow, the parascutella slightly darker; mediotergite reddish yellow, its posterior third blackened. Pleura yellow, with a broad, conspicuous, dorsal black stripe extending from the propleura to the pleurotergite; ventral sternopleurite less intensely darkened. Halteres with stem yellow, the knob very weakly darkened. Legs with the coxæ and trochanters yellow, the fore coxæ slightly darkened; femora light yellow, the tips conspicuously darkened, the amount subequal on all legs; tibiæ obscure yellow, the tips blackened; basitarsi obscure yellow, the tips and remainder of tarsi black. Wings whitish subhyaline, the small circular stigma brown; veins brown, those in the prearcular and costal fields yellow. Venation:  $Sc_1$  ending about opposite mid-length of  $Rs$ ; cell 1st  $M_2$  long, subequal to vein  $M_{1+2}$  beyond it;  $m-cu$  more than one-half its length beyond the fork of  $M$ .

Abdominal tergites banded dark brown and yellow, the bases brown, the broad apical margins yellow; sternites and hypopygium obscure yellow. Male hypopygium (fig. 4) with the apex of basistyle,  $b$ , obtusely rounded, the spine very reduced, as in *jocosa*, placed on the side of style near the point of insertion of the dististyles. Outer dististyle,  $od$ , a strong club, the outer angle of which is abruptly narrowed into a strong black spine, the dilated portion at base of club with appressed spinulæ. Inner dististyle as figured. Ædeagus,  $a$ , with the blackened apical point small.

*Hab.* Peru (Junin).

*Holotype*, ♂, Satipo, Jauja, altitude 800–900 metres, January 1, 1940 (*Paprzycki*).

*Teucholabis* (*Teucholabis*) *subjocosa* is most nearly allied to *T. (T.) jocosa* Alexander, widespread in South America, differing in the very heavily patterned thoracic pleura and in the structure of the male hypopygium, especially the clavate outer dististyle.

*Teucholabis (Teucholabis) inepta*, sp. n.

General coloration ferruginous, the mesonotum with a blackened spot on sides behind the suture; pleura with a broad diffuse brown dorsal stripe; femora yellow, the extreme tips weakly darkened; wings with a yellowish tinge, the oval stigma dark brown; abdominal segments ringed brown and yellow, their bases brown, the apices yellow; male hypopygium of peculiar structure, especially the aedeagus which is dilated into a setiferous blade bearing a long looped accessory rod.

*Male*.—Length about 5.5 mm.; wing 5.8 mm.

*Female*.—Length about 6 mm.; wing 5.5 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval with long verticils. Head grey.

Pronotum yellowish ferruginous. Mesonotal ferruginous, the præscutum with vague indications of a blackened spot on the extreme cephalic median portion; a small blackened spot on sides of scutal lobes behind the suture; posterior central portion of præscutum, median area of scutum and the scutellum yellow. Pleura obscure ferruginous, with a broad but diffuse brown longitudinal stripe extending from the propleura across the dorsal pleurites and ventral pleurotergite to the posterior portion of the mediotergite. Halteres obscure yellow. Legs with the coxæ and trochanters yellow; femora yellow, the extreme tips of the fore and middle pair pale brown, of the hind pair less evidently darkened; tibiae and tarsi yellow, the outer tarsal segments dark brown. Wings with a yellowish tinge, the oval stigma dark brown; veins obscure yellow to brownish yellow, those along cord dark brown. Costal fringe (male) moderately long. Venation: *Sc* long, *Sc*<sub>1</sub> ending beyond mid-length of *Rs*, *Sc*<sub>2</sub> some distance from its tip; cell 1st *M*<sub>2</sub> relatively long, its inner end pointed; *m-cu* varying from about one-third to one-half times its length beyond fork of *M*.

Abdominal segments ringed with brown and yellow, the bases of the segments brown, the broader apices yellow; hypopygium yellow. In the female the apical margins of the segments are more narrowly yellow. Male hypopygium (fig. 5) with the apex of basistyle, *b*, prolonged into a straight blade that narrows into a slender black spine, the surface of the blade, except at base, with abundant long erect setæ; a further small spinuliferous

point at extreme apex of basistyle. Outer dististyle, *od*, a simple, gently sinuous rod that terminates in a short black point, the surface of style with unusually long coarse setæ, the subbasal portion gently dilated. Inner dististyle, *id*, a single curved blackened blade, at base with a long tail-like extension that parallels the outer margin of blade, at apex narrowed into a long black spine bearing a single strong seta at the point of narrowing. Phallosome, *p*, of very peculiar structure, somewhat as in *idiophallus*, sp. n., consisting of a compressed pale blade that is densely provided with abundant coarse and delicate setæ, with a further elongate looped sclerotized rod.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Pumahuasi, altitude 980 metres, August 12, 1939 (*Woytkowski*). *Allotopotype*, ♀, pinned with type.

The peculiar structure of the male hypopygium readily separates the present fly from all similar species with the exception of *Teucholabis* (*Teucholabis*) *idiophallus*, sp. n., which has the general structure of the ædeagus similar yet differing in the details. Superficially both of these flies suggest species such as *T. (T.) jocosu* Alexander, *T. (T.) subjocosa*, sp. n., or *T. (T.) pleuralis* Alexander, but are vastly different in the structure of the male hypopygium.

*Teucholabis* (*Teucholabis*) *idiophallus*, sp. n.

Mesonotum yellow, patterned with brown; lateral portions of scutal lobes with conspicuous blackened areas; pleura yellow with a broad black dorsal stripe; wings subhyaline, stigma small, subcircular, dark brown; male hypopygium with basistyle produced apically into a blackened flange; phallosome appearing as a broadly flattened yellow membrane with a long, more sclerotized loop.

*Male*.—Length about 5.5 mm.; wing 5.8–6 mm.

*Female*.—Length about 5 mm.; wing 5 mm.

Rostrum and palpi black. Antennæ black; flagellar segments oval, with long verticils. Head dark grey.

Pronotum and pretergites yellow. Mesonotal præscutum patterned with dark chestnut-brown, the lateral and humeral portions broadly yellow; central portion of præscutum slightly paler, with a weak capillary darkened vitta that is more expanded at cephalic margin of sclerite; scutal lobes chestnut-brown, with a large blackened

lateral spot above wing root; central portion of scutum obscure yellow, at the suture with a conspicuous darkened triangular area; scutellum yellow, parascutella darker; mediotergite yellow, the posterior half brownish black. Pleura yellow with a broad black dorsal stripe extending from the cervical region to the posterior portion of mediotergite, relatively narrow on the pleurotergite; ventral sternopleurite and meron more reddened, dorsal sternopleurite more silvery pruinose. Halteres pale yellow. Legs with the coxæ and trochanters yellow; femora yellow, the tips narrowly and weakly darkened, in cases with the darkening scarcely evident; tibiæ yellow; tarsi passing into brownish black; posterior basitarsi of male weakly expanded on proximal portions. Wings broad, subhyaline; stigma small, subcircular, dark brown; veins yellow, somewhat darker along cord. Costal fringe of male relatively long and dense. Venation: *Sc* moderately long, *Sc*<sub>1</sub> ending about opposite mid-length of the long *Rs*; *R*<sub>1+2</sub> a little longer than *R*<sub>2+3+4</sub>; cell 1st *M*<sub>2</sub> long; *m-cu* nearly one-half times its own length beyond fork of *M*.

Abdomen conspicuously banded, the basal half of the segments brownish black, the broad posterior borders obscure yellow; outer segments and hypopygium yellow. Male hypopygium (fig. 6) with the apical lobe of basistyle, *b*, produced into a broad flange, the oblique apex blackened and microscopically toothed, the outer angle produced into a curved black spine; surface of blade with abundant microscopic setulæ; basistyle with no well-developed mesal flange. Outer dististyle, *od*, a simple darkened cylindrical rod, gently sinuous, the tip narrowly apiculate, the surface with conspicuous setæ. Inner dististyle, *id*, with the outer lobe produced into a long slender black spine, the tip acute, beyond mid-length with two small setæ; inner lobe shorter and broader, narrowed to an acute point. Phallosome, *p*, of very unusual shape for a member of the genus, approached only by *inepta*, appearing as a broadly flattened yellow membrane with a long, more sclerotized band or loop. Sternal pockets (male) weakly developed.

*Hab.* Peru (Junin).

*Holotype*, ♂, Satipo, Jauja, altitude 800–900 metres, July 29, 1940 (*Paprzycki*). *Allotopotype*, ♀, with the type. *Paratopotypes*, 1 ♂, with type; 1 ♂, December 12, 1940.

*Teucholabis* (*Teucholabis*) *idiophallus* is related to *T.* (*T.*) *inepta*, sp. n., likewise from Peru, both species having the same general type of phallosome, which is quite unique in the genus. The present fly is readily told from *inepta* by the quite different apical lobe of the basistyle.

*Gonomyia* (*Progomyia*) *altivolans*, sp. n.

Belongs to the *quinqueplagiata* group; size large (wing, male, over 5.5 mm.); legs yellow, the tips of tibiæ narrowly but conspicuously dark brown; outer tarsal segments darkened; wings obscure yellow, the prearcular and costal portions light yellow; a single darkened band crosses the wing at the cord, including the stigma and involving the veins; male hypopygium with the basistyle terminating in a long curved spine, with a smaller triangular tooth at base of the plate.

*Male*.—Length about 5 mm.; wing 5.6 mm.

*Female*.—Length about 7 mm.; wing 7.2 mm.

Rostrum and palpi brownish black. Antennæ with scape and pedicel light yellow; basal flagellar segments bicolored, black, the bases narrowly yellow; outer segments uniformly darkened; flagellar segments oval, the outer segments more elongate. Head fulvous, more yellow in front.

Pronotum brownish grey; pretergites light yellow. Mesonotum brownish yellow, the surface more or less pruinose, with the usual polished black pattern of the group, including three areas on the præscutum and one on each scutal lobe; scutellum black, pruinose, its posterior border obscure yellow; mediotergite grey, the cephalic lateral portion light yellow; pleurotergite light yellow, the ventral margin darkened. Pleura yellow, heavily patterned with black on the anepisternum and ventral sternopleurite, the surface pruinose. Halteres with stem yellow, knob darkened, its apex light sulphur yellow. Legs with coxæ obscure yellow, the fore pair darkened basally; trochanters yellow; femora yellow; tibiæ yellow, the tips narrowly but conspicuously dark brown; tarsi yellow, the outer segments darkened. Wings with the ground-colour obscure yellow, the prearcular and costal areas light yellow; stigma and a band across the cord pale brown, involving the veins and the adjacent membrane, the stigma a little darker; remaining

veins yellow. Venation:  $R_2$  before mid-length of petiole of cell  $R_3$ ;  $m-cu$  before fork of  $M$ .

Abdomen with tergites darkened, especially the outer segments, the markings not forming dark triangles but involving the whole segment; sternites and hypopygium yellow. Male hypopygium (fig. 9) with the basistyle,  $b$ , terminating in a long curved spine, with a smaller triangular tooth at base of plate. Dististyles,  $id. od.$ , as shown.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Piedras Grandes, altitude 3000 metres, November 30, 1937 (Woytkowski). *Allotopotype*, d, November 17, 1937.

*Gonomyia* (*Progonomyia*) *altivolans* is closest to *G. (P.) acanthias* Alexander, differing in the single darkened band across wing, the uniformly darkened abdominal tergites, and in the details of structure of the male hypopygium, as the small lateral tooth at base of spine of the basistyle.

*Gonomyia (Lipophleps) heteromera*, sp. n.

Belongs to the *pleuralis* group; wings with a weak dusky tinge, the costal and outer radial fields yellow; cord and outer end of cell 1st  $M_2$  narrowly seamed with brown; male hypopygium with apical spine of basistyle about equal in length to the pale outer lobe, broad-based, gradually narrowed to an acute point, the mesal face with microscopic setulae; longest spine of phallosome approximately twice the length of the shorter, delicately fringed with setulae for virtually the entire length.

*Male*.—Length about 4 mm.; wing 4 mm.

Rostrum and palpi black. Antennae with scape, pedicel, and first segment of flagellum yellow; remainder of flagellum black with the usual very long verticils. Head obscure yellow, the central portion weakly darkened.

Pronotum, lateral pretergites and lateral border of praescutum light yellow, the last narrowly bordered internally by a blackened line. Mesonotal praescutum light chestnut-brown; scutal lobes similar, the median area broadly obscure yellow with a further narrow black median vitta; mesal edges of scutal lobes slightly darkened; scutellum obscure yellow, the posterior border and a median dash dark brown; mediotergite yellow, variegated with brown on cephalic half and again on

posterior border. Pleura pale yellow with very conspicuous but narrow black stripes that enclose a wider line of the ground-colour; dorsal pleurites pale brown. Halteres with stem obscure yellow, knob weakly darkened. Legs with coxæ yellow, the tips of the fore pair weakly darkened; trochanters yellow; femora brownish yellow darkening to brown just before the narrowly whitened tips; tibiæ and tarsi pale brown. Wings with a weak dusky tinge, the cells beyond cord more yellow, especially in the radial field; stigma dark brown, very conspicuous; cord and outer end of cell 1st  $M_2$  very narrowly seamed with brown, the colour involving the veins; costal border narrowly yellow; veins yellow, except as above described. Venation:  $Sc_1$  ending a short distance before origin of  $Rs$ .

Abdominal tergites obscure yellow, the caudal borders narrowly blackened, with paler linear markings on disk; sternites yellow, the borders blackened; hypopygium infuscated. Male hypopygium (fig. 10) with the apical lobe of basistyle,  $b$ , about equal in length to the pale outer lobe, broad-based, narrowed gradually to an acute black spine; width of spine across base about two-fifths the total length; mesal face of lobe with microscopic setulæ. Dististyle,  $d$ , bearing a strong curved black spine just before the outer end. Phallosome,  $p$ , a long-oval sclerotized plate bearing two spines that are very unequal in length, one being only about one-half the length of the other, both blackened and acutely pointed at apices; longest rod with a linear row of microscopic setulæ distributed over most of the length.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huacapistana, Tarma, altitude 3600–5400 feet, February 10, 1940 (*Woytkowski*).

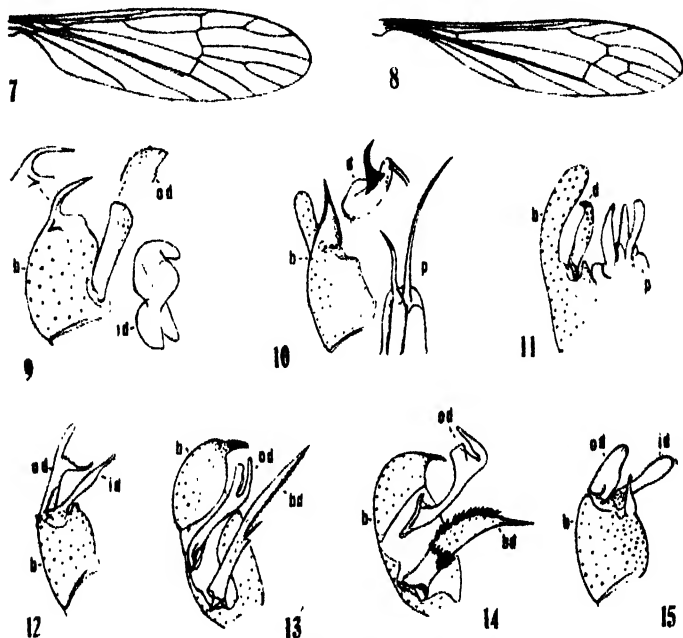
The nearest allied species is *Gonomyia* (*Lipophleps*) *peracuta* Alexander, of Mexico and Central America, which differs especially in the structure of the male hypopygium. The unusual length and great discrepancy in relative proportions between the two spinous elements of the phallosome furnish strong specific characters in the present fly.

*Gonomyia* (*Lipophleps*) *tribulator*, sp. n.

Belongs to the *manca* group; thoracic pleura rather heavily striped; legs brownish black to black; wings



with a weak brown tinge, the stigma very pale brown, scarcely differentiated from the ground;  $Sc_1$  ending a short distance beyond origin of  $R_s$ ; abdominal tergites uniform dark brown; male hypopygium with the basistyle produced beyond the dististyle as a conspicuous fleshy



- Fig. 7.—*Teucholabis (Paratropesa) fumidapicalis*, sp. n.; venation.  
 Fig. 8.—*Toxorhina (Oeratocheilus) superstes*, sp. n.; venation.  
 Fig. 9.—*Gonomyia (Progonomyia) albicollans*, sp. n.; male hypopygium.  
 Fig. 10.—*Gonomyia (Lipophleps) heteromera*, sp. n.; male hypopygium.  
 Fig. 11.—*Gonomyia (Lipophleps) tribulator*, sp. n.; male hypopygium.  
 Fig. 12.—*Erioptera (Empeda) instrenua*, sp. n.; male hypopygium.  
 Fig. 13.—*Molophilus (Molophilus) paganus*, sp. n.; male hypopygium.  
 Fig. 14.—*Molophilus (Molophilus) piger*, sp. n.; male hypopygium.  
 Fig. 15.—*Toxorhina (Oeratocheilus) superstes*, sp. n.; male hypopygium.

(Symbols: b, basistyle; bd, basal dististyle; d, dististyle; id, inner dististyle; ad, outer dististyle; p, phallosome.)

lobe; dististyle single, elongate, the length fully five times the greatest diameter, the tip narrowly blackened and curved; phallosome with about four points, one of which is narrowly blackened at apex and here provided with a few microscopic setulae.

*Male*.—Length about 3.5 mm. ; wing 4 mm.

Rostrum and palpi black. Antennæ black throughout ; flagellar segments long-cylindrical, with abundant long pale setæ. Head chiefly dark.

Pronotum infuscated ; pretergites yellow. Mesonotal præscutum grey pruinose, without distinct pattern, the humeral region more brightened ; scutum with median region yellow, the lobes extensively darkened ; scutellum yellow, the base infuscated ; mediotergite yellow, the central portion weakly darkened ; pleurotergite yellow. Pleura rather heavily striped, the dorsal portion dark brown, the ventral sclerites paler, obscure yellow, the two areas separated by a broad whitish longitudinal stripe ; dorsopleural membrane obscure yellow. Halteres weakly infuscated. Legs with coxæ weakly darkened ; trochanters obscure yellow ; remainder of legs brownish black to black, the femoral bases restrictedly brightened. Wings with a weak brown tinge, the prearcular and costal fields more yellow ; stigma very pale brown, scarcely differentiated from the ground ; veins brown, a little more brightened in the yellowish fields. Venation :  $Sc_1$  ending a short distance beyond origin of  $Rs$ ,  $Sc_2$  just before this origin branches off ;  $Rs$  relatively long ;  $m-cu$  just beyond fork of  $M$ .

Abdominal tergites dark brown, the sternites and hypopygium light yellow. Male hypopygium (fig. 11) with the basistyle,  $b$ , produced beyond the dististyle as a conspicuous fleshy lobe provided with long coarse setæ. Dististyle,  $d$ , single, subterminal, elongate, the length fully five times the greatest diameter, the tip blackened and slightly curved ; surface with about a dozen strong setæ, the outermost one stronger and fasciculate. Phallosome,  $p$ , with about four blades, one of which is narrowly blackened at tip and here provided with a few microscopic setulæ ; of the longer pale blades, one is subacute at tip, the other obtusely rounded ; a fourth obtuse point is much shorter.

*Hab.* Peru (Junin).

*Holotype*, ♂, Tulumayo Valley, Tarma, altitude 6000 feet, December 21, 1940 (Woytkowski).

*Gonomyia* (*Lipophleps*) *tribulator* is entirely different from all other described species, differing especially in the structure of the male hypopygium. It is perhaps as close

to *G. (L.) projecta* Alexander and *G. (L.) subterminalis* Alexander as to any other previously described forms but quite distinct.

*Trentepohlia (Paramongoma) laudabilis*, sp. n.

Mesonotal præscutum ferruginous with a posterior median darkening that extends backward across the suture on to the posterior sclerites, leaving the central area of scutum and scutellum pale; pleura and pleurotergite uniformly yellow; femora obscure yellow, the tips abruptly brownish black; tibiæ obscure brownish yellow, the tips blackened; all tarsi black; wings yellow, patterned with brown, including the wing-tip and seams on  $R_s$ , cord,  $R_5$ , and in the basal cells; abdominal tergites brown, the lateral borders yellow; sternites yellow.

*Female*.—Length about 10 mm.; wing 9 mm.

Rostrum obscure yellow; palpi black. Antennæ with scape black; pedicel dark brown; flagellum broken. Head dark brownish grey, the occiput paling to obscure buffy yellow; anterior vertex reduced to a narrow line that is less than one-half the diameter of scape.

Pronotum obscure brownish yellow. Mesonotal præscutum ferruginous, the posterior median portion with a broad black triangle, the point directed forward, each posterior-lateral angle produced backward over the scutal lobes and sides of the scutellum, leaving an obscure yellow median area on the scutum, scutellum, and extreme posterior portion of præscutum; mediotergite brownish black, the lateral borders paling to obscure yellow. Pleura and pleurotergite yellow. Halteres with stem obscure yellow, knob broken. Legs with the coxæ and trochanters yellow; femora obscure yellow, the tips abruptly brownish black, the amount subequal on all legs; tibiæ obscure brownish yellow, the tips more extensively blackened; tarsi black. Wings yellow, patterned with brown; stigma subcircular, dark brown; wing-tip narrowly darkened; restricted brown washes along  $R_s$ , cord, vein  $R_5$ , central portion of cell  $M$ , and along margin of cell 2nd  $A$ ; costal border clearer yellow; veins brown,  $C$  and  $Sc$  light yellow. Venation:  $Sc_1$  ending about opposite two-thirds the length of  $R_{3+4+5}$ ; vein  $R_5$  suberect; cell 1st  $M_2$  subequal in length to vein  $R_5$  beyond it;  $m-cu$  before fork of  $M$ ; distance on

posterior wing border between tips of veins  $Cu_1$  and 1st  $A$  about equal to one-half the length of  $m-cu_1$ .

Abdominal tergites brown, the first segment and lateral borders of succeeding segments yellow, more obscure on posterior segments; sternites yellow; genital shield darkened; cerci long and slender.

*Hab.* Peru (Huanuco).

*Holotype*, ♀, Piedras Grandes, altitude 3000 metres, September 14, 1937 (*Woytkowski*).

The most similar described species is *Trentepohlia* (*Paramongoma*) *fuscipes* Alexander, of Amazonian Brazil, which differs in all details of body, leg and wing-pattern, and in the venation, as the more oblique vein  $R_3$  and short cell 1st  $M_2$ .

*Erioptera (Empeda) destituta*, sp. n.

General coloration dark brown, the humeral region of præscutum and the scutellum obscure yellow; antennæ black throughout; halteres and legs dark; wings with a strong dusky tinge, the stigma a little darker; cell  $R_3$  very deep; abdomen brownish black; hypopygium obscure yellow; male hypopygium with the branch of the outer dististyle flattened, its apex obliquely truncated.

*Male*.—Length about 3.5 mm.; wing 4.5 mm.

*Female*.—Length about 4 mm.; wing 4.5 mm.

Rostrum and palpi black. Antennæ black throughout, moderately elongate; flagellar segments oval to long-oval. Head grey.

Pronotum dark brown; anterior lateral pretergites obscure yellow. Mesonotum dark brown, the humeral region of præscutum obscure yellow; scutellum obscure yellow. Pleura with propleura and mesepisternum darker brown than the brownish yellow posterior pleurites and pleurotergite. Halteres dark brown, the base of stem pale. Legs with coxæ yellow, the fore pair darker; trochanters obscure yellow; remainder of legs black, the femoral bases restrictedly obscure yellow; legs provided with flattened scales. Wings with a strong dusky tinge, the stigma a little darker, its limits ill-defined; veins brown, those in the prearcular field paler. Venation:  $Sc_1$  ending about opposite one-third the length of  $R_2$ ,  $Sc_2$  some distance from its tip, the degree somewhat variable; cell  $R_3$  very deep, as in *longifurcata*.

Abdomen brownish black ; hypopygium obscure yellow. Male hypopygium much as in *longifurcata*, differing as follows : Branch of the outer dististyle flattened, the apex obliquely truncated. In *longifurcata* the branch is a slender pale spine, the tip acute.

*Hab.* Peru (Junin).

*Holotype*, ♂, Carpapata, Tarma, altitude 2600 metres, May 3, 1940 (*Woytkowski*). *Allotype*, ♀, Huacapistana, Tarma, altitude 1110–1660 metres, March 3, 1940.

The present fly is closely allied to *Erioptera* (*Empeda*) *longifurcata* Alexander, of Ecuador, differing in slight details of coloration and in the structure of the male hypopygium, notably of the outer dististyle.

*Erioptera* (*Empeda*) *instrenua*, sp. n.

Size very small (wing, male, 3 mm.) ; general coloration dark brown, sparsely pruinose ; halteres infuscated ; legs dark brown ; wings with a greyish tinge, the prearcular and costal fields clear yellow ; stigma scarcely darker ; *Sc*<sub>1</sub> ending about opposite mid-length of *Rs*, *Sc*<sub>2</sub> far from its tip ; cell *R*<sub>2</sub> relatively shallow ; male hypopygium with the outer dististyle profoundly bifid, the inner arm arising at a right angle, with coarse teeth at its base.

*Male*.—Length about 2.5 mm. ; wing 3 mm.

Rostrum and palpi black. Antennæ black ; flagellar segments oval with very long verticils. Head grey.

Pronotum dark brown ; pretergites obscure yellow. Mesonotum dark brown, the surface very vaguely pruinose. Pleura reddish, heavily pruinose so as to virtually obscure the ground-colour. Halteres infuscated, the base of stem yellow. Legs with coxæ and trochanters brownish testaceous ; remainder of legs dark brown ; legs provided with linear scales in addition to the setæ. Wings with a greyish tinge, the prearcular and costal fields clear yellow ; stigma scarcely darker ; veins pale brown, trichia darker. Venation : *Sc*<sub>1</sub> ending about opposite mid-length of *Rs*, *Sc*<sub>2</sub> far from its tip, closer to origin of *Rs* than to tip of *Sc*<sub>1</sub> ; vein *R*<sub>2</sub> faint, placed at near two-fifths the length of petiole of cell *R*<sub>2</sub>, the latter relatively short ; *m-cu* at fork of *M*.

Abdomen brown, sternites a little brighter ; hypopygium brownish yellow. Male hypopygium (fig. 12) with the outer dististyle, *od*, profoundly bifid at near mid-length,

either arm subequal in length to the stem ; inner arm arising at a right angle to the main axis, its outer or axillary margin with two or three coarse denticles. Inner dististyle, *id*, slender, beyond mid-length a little dilated, thence narrowed to the apex.

*Hab.* Peru (Junin).

*Holotype*, ♂, Satipo, Jauja, altitude 800–900 metres, January 18, 1940 (*Paprzycki*).

The species having a hypopygium most similar to the present fly is *Erioptera* (*Empeda*) *divaricata* Alexander, of southern Mexico, which differs in the shorter *Sc* and in the details of structure of the male hypopygium, especially of the lateral arm of the outer dististyle and the conformation of the inner dististyle.

*Molophilus* (*Molophilus*) *paganus*, sp. n.

Belongs to the *plagiatus* group ; general coloration dark brown, including the entire thorax ; antennæ moderately long, black throughout ; halteres with light yellow knobs ; legs dark brown ; wings brownish yellow, with two slightly darker cross-bands, the second one at cord ; abdomen, including hypopygium, black ; male hypopygium with the basal dististyle a slender, gently curved rod, the mesal edge with a series of from 16 to 18 strong appressed spines ; at near one-third the length the style bears a strong lateral tooth on margin and a slender black spine on face.

*Male*.—Length about 6 mm. ; wing 6.5 mm. ; antenna about 2 mm.

Rostrum and palpi dark brown. Antennæ black throughout, relatively elongate ; flagellar segments sub-cylindrical to cylindrical ; longest verticils exceeding the segments. Head dark brownish grey.

Pronotum brownish black ; pretergites black. Mesonotum dark brown, the central area of præscutum still darker, brownish black ; posterior sclerites of notum, especially the scutellum, slightly pruinose. Pleura, including dorsopleural membrane, brownish black, very sparsely pruinose. Halteres yellow, the apex of knob clear light yellow. Legs with the coxæ brownish black ; trochanters brownish testaceous ; remainder of legs uniformly dark brown. Wings with the ground-colour brownish yellow, with two slightly darker, light brown cross-bands, the outer one at cord, the inner at near

one-fifth the length of wing; veins yellow, darker in the patterned areas; macrotrichia light brown, those along cord darker. Venation:  $R_2$  lying shortly distad of level of  $r-m$ ; petiole of cell  $M_3$  a little more than twice the length of  $m-cu$ ; vein 2nd  $A$  long, ending about opposite one-third the length of petiole of cell  $M_3$ .

Abdomen, including hypopygium, black. Male hypopygium (fig. 13) with the beak of basistyle,  $b$ , stout, cultriform. Basal dististyle,  $bd$ , a slender, gently curved rod, with a strong tooth or triangular lobe on mesal edge at near one-third the length; on face of style nearly opposite this tooth with a slender black spine; lower or mesal edge of style on distal two-thirds with about 16 to 18 strong appressed spines, the more basal ones shorter and stouter; apex of style an acute spine.

*Hab.* Peru (Huanuco).

*Holotype*, ♂, Piedras Grandes, altitude 3000 metres, November 17, 1937 (*Woytkowski*).

*Molophilus (Molophilus) paganus* is quite distinct from all other related species in the details of structure of the male hypopygium. This agrees most closely with *M. (M.) capricornis* Alexander, of Colombia, but the details are quite different.

*Molophilus (Molophilus) piger*, sp. n.

Belongs to the *plagiatus* group; allied to *perseus*; general coloration dark brownish grey; antennæ short in both sexes; halteres pale yellow; legs brownish black, the femoral bases obscure yellow; wings greyish subhyaline, with two slightly darker, pale brown cross-bands, the second at the cord; abdomen brownish black, the hypopygium a little brightened; male hypopygium with the basistyle a strong rod terminating in a long straight spine, the outer margin of style with a linear series of from 10-16 suberect spines, the side of style at basal third with a further group of strong spines and setæ.

*Male*.—Length about 4-4.5 mm.; wing 5-5.5 mm.

*Female*.—Length about 5.5 mm.; wing 5.5 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval, gradually decreasing in length outwardly, the terminal segment smallest. Head dark grey.

Thorax almost uniform dark brownish grey, the præscutum with the humeral region a little reddened;

pretergites light yellow, pleura darker. Halteres uniform pale yellow. Legs with the coxæ dark brown; trochanters yellow; remainder of legs brownish black, the femoral bases obscure yellow. Wings greyish subhyaline, slightly more yellowed at base; two pale brown cross-bands, one at the basal fourth of wing, the second at cord; veins pale brown, trichia long, dark brown. Venation:  $R_2$  varying from about opposite to only a little beyond level of  $r-m$ ; petiole of cell  $M_3$  about twice the length of  $m-cu$ ; vein 2nd  $A$  long and sinuous, terminating about opposite the cephalic end of  $m-cu$  or slightly beyond.

Abdomen brownish black; hypopygium a little brightened. Male hypopygium (fig. 14) with the beak of basistyle,  $b$ , slender, around its base with numerous small setæ. Outer dististyle,  $od$ , with the two arms very unequal in size and shape. Basal dististyle,  $bd$ , a strong rod, terminating in a long straight spine; outer margin back from spine for more than one-half the remaining length of style with a single linear unbroken series of from 10 to 16 strong suberect spines; side of style at basal third with a further group of strong spines and setæ. Phallosomic plate narrow, obtusely rounded at apex.

*Hab.* Peru (Junin).

*Holotype*, ♂, Carpapata, Tarma, altitude 2600 metres, May 3, 1940 (Woytkowski). *Allotopotype*, ♀, May 1, 1940. *Paratopotypes*, 4 ♂ ♀, May 3-4, 1940.

*Molophilus* (*Molophilus*) *piger* is closest to *M.* (*M.*) *chiriquiensis* Alexander, of northern Panama, which differs in the smaller size, slightly different coloration, and the details of structure of the male hypopygium, especially the basal dististyle, which is long and narrow, with only seven or eight strong spines on outer margin. *M.* (*M.*) *perseus* Alexander, of Colombia, is also allied, differing very evidently in the unpatterned wings. The original description of *perseus* describes the thorax as being light yellowish brown, but the notum is more correctly described as being dark brownish grey.

*Toxorhina* (*Ceratocheilus*) *superstes*, sp. n.

Allied to *americana*; general coloration grey, the præscutum with three conspicuous black stripes, the scutal lobes similarly darkened; halteres pale yellow; legs black; wings subhyaline, the prearcular field yellow; veins delicate; anterior branch of  $Rs$  longitudinal in



position; cell 2nd *A* long; male hypopygium with the outer branch of style a simple unnotched structure, the inner branch a pale spatulate blade.

*Male*.—Length, excluding rostrum, about 6 mm.; wing 6.5 mm.; rostrum about 5 mm.

Rostrum nearly as long as body, black. Antennæ short, black throughout; flagellar segments short and crowded. Head grey, the centre of vertex infuscated.

Cervical region black. Pronotum grey. Mesonotum light grey, the præscutum with three conspicuous black stripes, the scutal lobes similarly darkened. Pleura grey, variegated with darker, especially on the dorsopleural region and ventral sternopleurite. Halteres uniformly pale yellow. Legs with the coxæ brownish testaceous, grey pruinose; trochanters brownish yellow; remainder of legs brownish black, the femoral bases restrictedly brightened. Wings (fig. 8) subhyaline, the prearcular field yellow; veins brown, those in the prearcular field yellow. Veins much more delicate than in *americana*. Venation: Compared with *americana*, anterior branch of *Rs* more longitudinal in position so that cell *R*<sub>2</sub> at margin is more extensive, approximately one-third as wide as cell *R*<sub>4</sub>; cell 1st *M*<sub>2</sub> small, shorter than the veins beyond it; cell *M*<sub>4</sub> correspondingly deep; cell 2nd *A* longer.

Abdominal tergites dark brown, pruinose; basal sternites brightened; hypopygium obscure yellow. Male hypopygium (fig. 15) with the apical spine of basistyle, *b*, broad on basal half, thence narrowed to the subacute tip. Outer dististyle, *od*, a simple, unnotched structure that gradually narrows outwardly, the darkened tip obtuse; surface of basal two-thirds with abundant microscopic setulæ; apex microscopically roughened. Inner dististyle or branch, *id*, a long pale spatula, its base with numerous strong setæ, the distal half a flattened oval blade.

*Hab.* Peru (Junin).

*Holotype*, ♂, Huacapistana, Tarma, altitude 3600–5400 feet, February 6, 1940 (*Woytkowski*).

*Toxorhina* (*Ceratocheilus*) *superstes* is quite distinct from *T. (C.) americana* (Alexander), which is its nearest ally. It is readily told by the venation and especially by the structure of the male hypopygium, notably of the dististyles.

**XXXVII.—Ants from the Colombo Museum Expedition to Southern India, September–October 1938.** By HORACE DONISTHORPE, F.Z.S., F.R.E.S., etc.

[Plate II.]

THE ants in this collection comprise some thirty-eight forms, including eight new species and one new variety. Some of the species are found in Ceylon, others in Burma, and the whole collection is of considerable interest.

Subfamily **Ponerinae**.

1. *Diacamma rugosum* Le Guill., var. *jerdoni* Forel, Rev. Suisse Zool. ii. p. 401 (1903); [*sculptum* Bingham, Faun. Brit. Ind., Hym. ii. p. 80 (1903).]

Five ♂♂. Nadungayam. 200 ft., Malabar, S. India, 16–22. ix. 38.

*Distribution*.—Ceylon; widely distributed in India.

2. *Pachycondyla (Bothroponera) tesserinoda* Emery, Ann. Mus. Stor. Nat. Genova, ix. p. 368 (1877).

Four ♂♂. Dohnavur, 350 ft., Tinnevely District, S. India, 30. ix. and 1. x. 38.

*Distribution*.—Ceylon, S. India, Assam, Burma.

3. *Pachycondyla (Bothroponera) henryi*, sp. n.

♂. Dark brown, mandibles, antennæ, lobes of frontal carinæ, posterior border of segments of gaster narrowly, and legs reddish, tarsi and apex of antennæ lighter, teeth of mandibles black. Clothed with long outstanding and short decumbent yellow hairs. Sculpture consisting of large shallow punctures, space between more or less rugose and marked with fine small punctures.

*Head* large, subquadrate, broader than thorax, posterior angles rounded, posterior border slightly emarginate; *mandibles* large, triangular, finely striate, and with larger and smaller punctures, masticatory border armed with seven blunt teeth, the apical one longer and more pointed; *clypeus* narrow, with a medial carina, anterior margin bluntly pointed in centre; *frontal carinæ* large, lobes well developed; *frontal furrow* short, but rather wide and deep; *antennal fossæ* large and deep; *antennæ* long, stout, *scape* not reaching posterior border of head; first joint of *funiculus* if anything shorter than second, last joints thickened to apex, last joint somewhat flat, bluntly pointed, longer than the two preceding taken together;

eyes moderate, oval, somewhat convex. *Thorax* narrowed to base; *pronotum* convex, rounded in front and at sides, *pro-mesonotal* suture distinct; *meso-epinotal* suture wanting; *epinotum* unarmed, gradually sloping to base, no marked angle between dorsal surface and declivity. Node of *pedicel* simple, unarmed, convex, rounded anteriorly and at sides; *gaster* narrowed to base, the constriction between the first and second segments very marked, the puncturation of the last segments not nearly so coarse as that of the rest of the body.

Long. 11 mm.

This distinct species comes nearest to *tesserinoda*, but besides being considerably larger the sculpture is entirely different.

Described from two workers. Dolnavur, Tinnevely District, S. India, 30. ix. 38.

Type in B.M. (N.H.).

I have named this species in honour of Mr. G. M. Henry, who captured the ants of this expedition.

4. *Euponera* (*Mesoponera*) *melunaria* Emery, Ann. Soc. Ent. France, lxii. 260, note (1893).

♂ (undescribed). Brownish yellow, eyes black, antennæ except scape and first joint of funiculus dark brown, covered with long outstanding and short decumbent yellow hairs, shining, very finely punctured.

Head about as long as broad, rounded behind eyes, posterior border slightly emarginate, with a narrow raised margin; *mandibles* short, reduced, bluntly pointed; *clypeus* convex, rounded anteriorly; *clypeal foveæ* round, deep; *suture* between clypeus and frontal area distinct; *frontal area* large, flat, triangular, finely but distinctly defined; *frontal carinæ* very short, round; *antennæ* long, 13-jointed; *scape* short, slightly longer than broad; *funiculus* with 1st joint very short, transverse, considerably shorter and somewhat narrower than scape; the rest of the joints longer than broad, of about equal breadth, last joint slightly longer than the preceding; *eyes* large, kidney-shaped, situated on each side of the head; *ocelli* moderate, oval, placed on vertex of head. *Thorax* convex, narrowed in front and behind, broadest just before insertion of the wings; *pronotum* transverse, furnished with a short, finely margined neck, dorsal surface convex, sides encircling the mesonotum; *meso-*

*notum* very convex, broad oval, sides and front rounded, a short pointed carina extends from centre of anterior border ending in a rather broad short furrow; *mayrian* furrows wanting; *parapsidal* furrows narrow but distinct; the mesonotum and scutellum are divided by a short transverse furrow; *scutellum* convex and prominent; *metanotum* narrow, transverse, somewhat raised; *epinotum* long, sloping, no angle between dorsal surface and declivity. *Petiole* furnished with a rather high node, straight posteriorly, sloping anteriorly, armed beneath with a projection toothed at apex and base; *gaster* short, oval, constriction between *post-petiole* and second segment well marked; *pygidium* armed with a long, sharp, curved spine; *cerci* well developed; *genitalia* prominent; *stipites* large, curved, bluntly pointed; *sagittæ* sharply pointed. *Wings* iridescent, *veins* and *pterostigma* light brown; two *discoidal*, two *cubital* cells present; *radial cell* long, closed, slightly appendiculate.

*Long.* 6.3 mm.

Described from a single specimen, Nadungayam, 200 ft., Malabar, S. India, 16-22. ix. 38. Male type in B.M. (N.H.).

5. *Cryptopone testacea* Mots., Bull. Soc. Nat. Mosco, xxxvi. p. 15 (1863), ♀; Emery, Ann. Soc. Ent. France, 1893, p. 240, ♂.

Seven winged ♀♀. Nadungayam, 200 ft., Malabar, S. India, 16-22. ix. 38.

*Distribution.*—Ceylon.

♂ (undescribed). Yellow, eyes black, pubescence, sculpture and colour much as in ♀.

*Head* across eyes about as broad as long, slightly narrowed posteriorly, posterior angles rounded; *mandibles* small, much reduced, pointed at apex; *clypeus* convex, anterior border rounded; *clypeal foveæ* very small, round; *cheeks* very short; *frontal* carinæ very short, round, with a small shallow hollow between; *frontal* furrow short; *antennæ* missing; *eyes* large, somewhat kidney-shaped, situated at sides of head, anterior border very close to posterior border of clypeus; *ocelli* round, prominent, not close together. *Thorax* not broader than head together with eyes, narrowed posteriorly; *pronotum* transverse, margined and furnished with a neck anteriorly, sinuate on each side; *mesonotum* convex, oval, slightly broader than long,

with a short median furrow anteriorly; *mayrian furrows* very indistinctly indicated; *scutellum* convex, subquadrate; *metanotum* transverse, slightly prominent; *epinotum* rounded, not showing an angle between dorsal surface and declivity; *node* of *petiole* rather high, thick, rounded at apex, anterior surface sloping, posterior surface straight; *gaster* long, slightly curved, without a constriction between *post-petiole* and second segment, but the suture very distinctly defined; *hypopygium* armed with a short, sharp, curved spine; *cerci* developed; *genitalia* indistinct. *Legs* long, slender, all the tibiae furnished with one pectinate spur. *Wings* as in the ♀, but shorter, iridescent, *pterostigma* and *veins* yellow, one *discoidal*, two *cubital*, and one long, closed, *radial cell* present.

*Long.* about 5 mm.

Described from a male. Dohnavur, 350 ft., Tinnevely District, S. India, 5. x. 38.

I believe this to be the male of *Cryptopone testacea*; though larger, it agrees fairly well with Wheeler's descriptions of the males of two species of *Cryptopone* from Java and Borneo respectively.

♂ type in B.M. (N.H.).

It is doubtful if Emery's worker belongs to the same species as Motschulsky's female. The length of the former is only 2.5 mm., whilst that of the latter is 5 mm. and over. In all the known species of *Cryptopone* the female is very little larger than the worker. Bingham [Faun. Brit. India, Hym. ii. p. 105 (1903)] incorrectly gives the length of the worker as 6 mm.

6. *Leptogenys (Lobopelta) processionalis* Jerdon, Madras Journ. Lit. Sci. xvii. p. 118 (1851).

One ♂, 11 ♀♀. Tenmalai, 500–800 ft., Travancore, S. India, 11–17. x. 38.

*Distribution.*—India, Ceylon.

7. *Anochetus mordax*, sp. n.

♀. Brownish yellow, disc of head, pronotum, and petiole yellowish brown, mesonotum and epinotum varying from black to blackish brown, legs yellow, eyes black; shining; clothed with not long, scattered, outstanding yellow hairs; scape of antennae pubescent.

*Head* chiefly smooth and shining, across the eyes about as broad as long, posterior border deeply excised, posterior angles bluntly rounded, sides of head sinuate before the

rounded prominence below eyes and more gradually so behind the same; *mandibles* about as long as two-thirds of the head, with a few scattered small punctures on upper surface, armed with three pointed apical teeth, the lower one being the longest, the middle one, which is situated on the lower tooth near to the junction of that with the upper tooth, is much shorter than the other two, a row of extremely small denticles, or little tubercles, extends along the inner margin of the mandibles below the apical teeth; *clypeus* concave anteriorly, slightly convex posteriorly, anterior margin roundly excised, anterior angles terminating in a blunt point, narrowed and extending in a point which is finely longitudinally striate, between the frontal carinæ; *frontal carinæ* and *vertex* of head finely longitudinally striate, the striæ of the latter oblique at sides; *antennal furrow* broad; *eyes* large, round-oval, prominent, with a few curved striæ round inner sides; *antennæ* long, *scape* extending a little beyond posterior angles of head, all the joints longer than broad, first joint considerably longer than second, last joint a little longer than the two preceding taken together. *Thorax* long, narrow; *pronotum* not as broad as head, but considerably broader than rest of thorax, convex, rounded and finely margined at sides, narrowed in front to form a neck which is transversely striate, sides of disc longitudinally striate; dorsal surface of *mesonotum* transversely striate, sides smooth; *epinotum* transversely striate, dorsal surface considerably longer than declivity, the latter rather abrupt. *Scale of pedicel* high, unarmed, rounded at apex, anterior surface slightly concave, sloping, posterior surface flat; *gaster* long oval, smooth and shining, narrowed behind, constriction between 1st and 2nd segments marked.

*Long.* 7 mm.

Described from 11 workers. Dohnavur, 350 ft., Tinnevely District, S. India, 30. ix. 38.

Type in B.M. (N.H.).

This species does not fit into the tables of either Forel [Journ. Bombay Nat. Hist. Soc. xiii. pp. 58-60 (1900)] or Bingham [Faun. Brit. India, Hym. ii. pp. 39-40 (1903)]. Of the species described since it comes nearest to *A. gracilis* Karawajew from Java [Knowia, iv. p. 286 (1925)], but the construction of the apical teeth of the mandibles is quite different, etc.

*Note*.—In Bingham's table (*l. c.*) he gives for *A. yerburyi* Forel: "Pro-, meso- and metanotum punctate, not striate," and in the description, "Head . . . faintly longitudinally striate. . . . The meso- and mesonotum transversely striate" !

Subfamily **Pseudomyrmecinae**.

8. *Sima rufonigra* Jerd., Madras Journ. Lit. Sci. xvii.\* p. 111 (1851).

One del. ♀, 2 ♂♂. Trenmalat, 500–800 ft., Travancore, S. India (♀); Dohnavur, 350 ft., Tinnevely District, S. India, i. x. 38 (♂♂).

*Distribution*.—Continental India, Ceylon, Sumatra.

9. *Tetraponera nigra* Jerd., Madras Journ. Lit. Sci. xvii. p. 112 (1851).

One del. ♀. Dohnavur, 350 ft., Tinnevely District, S. India, i. x. 38.

*Distribution*.—Continental India, Ceylon.

Subfamily **Myrmecinae**.

10. *Pheidole* (*Pheidole*), sp. ?

Ten ♂♂. Dohnavur, 350 ft., Tinnevely District, S. India, 30. ix. 38.

It is quite impossible to name the workers of *Pheidole* species unless a soldier be present also.

11. *Myrmicaria brunnea* Saunders, Trans. Ent. Soc. Lond. iii. p. 57 (1841).

Eight ♂♂. Nadungayam, 200 ft., Malabar, S. India, 16–22. ix. 38, and Dohnavur, 350 ft., Tinnevely District, S. India, 30. ix. 38.

*Distribution*.—India, Ceylon, Sumatra.

12. *Crematogaster* (*Acrocalia*) *brunnea* Smith, subsp. *subnuda* Mayr, Verh. Zool. Bot. Ges. Wien, xxviii. p. 682 (1878).

Three ♂♂. Dohnavur, 350 ft., Tinnevely District, S. India, 30. ix. 38.

*Distribution*.—India, Assam, Burma.

\* In the 'Genera Insectorum' the volume is incorrectly given as "15."

13. *Crematogaster (Acrocasia) rothneyi* Mayr, Verh. Zool. Bot. Ges. Wien, xxviii. p. 685 (1878).

One ♀. Dohnavur, 350 ft., Tinnevelly District, S. India, 1. x. 38.

*Distribution.*—India.

14. *Monomorium (Holcomyrme) glabrum* André. Spec. Hym. Europe, ii. p. 345 (1883).

Four ♀♀. Dohnavur, 350 ft., Tinnevelly District, S. India, 1. x. 38.

*Distribution.*—The whole of India. Ceylon and Burma.

15. *Monomorium (Holcomyrme) scabriceps* Mayr, Verh. Zool. Bot. Ges. Wien, xxviii. p. 672 (1878).

One ♀. Dohnavur, Tinnevelly District, 350 ft., S. India. 8. x. 38.

*Distribution.*—India.

16. *Meranoplus levis*, sp. n.

♀. Head, thorax, antennæ, legs, first joint of pedicel, and anterior margin of gaster very narrowly, yellowish red, eyes and teeth of mandibles black, club of antennæ brown, post-petiole reddish brown, bordered with black, gaster very dark brown, almost black. Head, thorax and petiole mostly smooth, shining, clothed with longer and shorter outstanding yellow hairs, thicker on the gaster.

*Head* slightly longer than broad, narrowed in front, sides rounded, sinuate before posterior angles, posterior angles pointed, posterior border truncate, vertex, with a few faint longitudinal striæ; *mandibles* triangular, closely longitudinally striate, armed with four sharp teeth; *clypeus* flat, with a few longitudinal striæ, a narrow carina on each side ends in a small sharp tooth at corners of anterior border, which is margined and truncate; *frontal area* indistinct; *frontal carinæ* pointed, widely separated, continued to form a margin above the large wide, shallow, smooth antennal grooves; *antennæ* fairly long, 9-jointed, with a 3-jointed club; *cheeks* with several raised longitudinal ridges; *eyes* moderate, round-oval, prominent.

*Thorax* transverse; *pro-mesonotal shield* transverse, convex, covered with a number of faint oblique longitudinal striæ, narrowly margined anteriorly, sinuate before the short, pointed, anterior angles, posterior angles armed with a rather long pointed spine, posterior border margined; *epinotum* concave, margined at sides, armed with two long



thin sharp spines; *petiole* flat, transverse, margined; *post-petiole* globose, margined, slightly narrowed posteriorly, covered with a network of raised ridges; *gaster* heart-shaped, anterior border excised and narrowly margined, sculpture of anterior portion consisting of finely raised longitudinal ridges and very fine punctures.

*Long.* 4.3 mm.

Described from two workers. Dohnavur, 350 ft., Tinnevely District, S. India, 1. x. 38.

Type in B.M. (N.H.).

This very distinct species is chiefly distinguished by its mostly smooth surface.

There are four specimens of this species in the B.M. from Ceylon: "S. P. Hambantota, T. B. F., 6 & 7 Feb. '09. Ceylon, T. B. Fletcher, 1909—137."

17. *Meranoplus carinatus*, sp. n.

♀. Head, thorax and legs black, cheeks yellow above, petiole and post-petiole yellowish brown, gaster brownish yellow with dark markings, clothed with longer and shorter outstanding curved yellow hairs, thicker on gaster. Sculpture of dorsal surface of head and thorax consisting of longitudinal raised ridges, or carinae, which form a network and enclose larger and smaller, round, shallow punctures.

*Head* triangular, narrowed in front, broadest behind, posterior angles round, prominent, posterior border slightly but widely excised; *mandibles* massive, triangular, covered with numerous fine raised ridges, armed with four strong teeth; *clypeus* concave before anterior border, which is truncate, smooth and shining, with scattered punctures, thicker at the sides; *frontal area* transverse, triangular, smooth and shining; *cheeks* with strong longitudinal raised ridges; antennal grooves wide, deep, smooth and shining anteriorly, striate posteriorly; *antennae* missing; *eyes* large, convex, round-oval; *ocelli* moderate. *Thorax* triangular, broadest across anterior angles, dorsal surface flat, anterior angles pointed; *suture* between mesonotum and scutellum narrow but deep; *scutellum* transverse, triangular; *epinotum* armed with two short, broad, but pointed teeth, *dorsal surface* shorter than declivity, longitudinally striate, *declivity* somewhat concave, very smooth and shining. *Petiole* with a rather high node, bidentate at apex, anterior surface slanting,

smooth and shining, posterior surface shorter, smooth and shining in centre, striate at sides, sides of petiole with shallow round punctures enclosed in raised ridges, armed beneath with a narrow projection, ending in a short blunt tooth anteriorly, projecting forward; *post-petiole* with sculpture similar to but stronger than that of petiole, globose, rounded at sides and in front, margined behind; armed beneath with a short sharp tooth projecting downwards; *gaster* oval, somewhat deeply excised anteriorly, the very long first segment covered with moderate, shallow, round punctures. *Wings* wanting.

*Long.* 8.5 mm.

Type in B.M. (N.H.).

Described from a deâlated female. Amarambalam Forest, 500–1500 ft., Malabar, S. India, 20. ix. 38.

This distinct species does not agree with any known description, nor does it belong to any of the workers described for these regions.

18. *Cataulacus latus* Forel, Hist. Nat. Madagascar, xx. p. 145 (1891).

One del. ♀, 6 ♂♂. Tenmalai, 500–800 ft., Travancore, S. India, 11–17. x. 38.

*Distribution.*—Bengal, Burma, Tenasserim.

#### Subfamily **Formiciniæ.**

19. *Anoplolepis longipes* Jerd., Madras Journ. Lit. Sci. xvii. 3. 122 (1851).

Two ♂♂. Tenmalai, 500–800 ft., Travancore, S. India, 11–17. ix. 38.

*Distribution.*—Warm parts of Asia; imported into the tropics by commerce, and becoming a cosmopolitan species.

20. *Ecophylla smaragdina* F., Syst. Ent. p. 828 (1755).

One del. ♀, 7 ♂♂. Dohnavur, 350 ft., Tinnevely District, S. India, 1. x. 38.

*Distribution.*—India, Indochina, Ceylon, Sonde Isles.

21. *Camponotus (Tansemyrmex) angusticollis* Jerd., Madras Journ. Lit. Sci. xvii. p. 120 (1851).

One large ♂. Siruvani-Muthikolam, 1700–3000 ft., Coimbatore District, S. India, 23–26. ix. 38.

*Distribution.*—India.

22. *Camponotus (Tanæmyrmex) barbatus* Rog., sub. sp. *taylori* Forel, Journ. Bombay Nat. Hist. Soc. vii. p. 241 (1892).

One ♀. Tenmalai, 500–800 ft., Travancore, S. India, 11–17. x. 38.

*Distribution*.—India.

23. *Camponotus (Tanæmyrmex) variegatus* Smith, Cat. Hym. Brit. Mus. vi. p. 19 (1858).

Two large ♂♂. Dohnavur, 350 ft., Tinnevely District, S. India, 1. x. 38.

*Distribution*.—Ceylon, Burma, Singapore.

24. *Camponotus (Tanæmyrmex) compressus* F., Mant. Ins. i. p. 307 (1787).

Thirty-two (♂♂ and ♀♀). Shencotta, S. India, 11. x. 38; Dohnavur, 350 ft., Tinnevely District, S. India, 1. x. 38.

*Distribution*.—India, Ceylon.

25. *Camponotus (Myrmosericus) rufoglaucus* Jerdon, Madras Journ. Lit. Sci. xvii. p. 124 (1851).

Thirty ♀♀. Dohnavur, 350 ft., Tinnevely District, S. India, 8. x. 38.

*Distribution*.—India, Ceylon, Assam, Burma.

26. *Camponotus (Myrmosericus) rufoglaucus* Jerdon, subsp. *paria* Emery, Ann. Mus. Stor. Nat. Genova, xxvii. p. 513 (1889).

Two ♀♀. Nadungayam, 200 ft., Malabar, S. India, 16–22. ix. 38.

*Distribution*.—India, Ceylon, Assam, Burma, Siam.

27. *Camponotus (Orthonotomyrmex) sericeus* F., Suppl. Ent. Syst. p. 279 (1798).

One del. ♀, 25 ♀♀. Tuticorin, S. India, 18. x. 38. This was probably a young colony, as none of the workers are large enough to be called soldiers. Sixty (♂♂ and ♀♀). Dohnavur, 350 ft., Tinnevely District, S. India, 30. ix., 1 & 8. x. 38. Some of these soldiers, and also workers, possess blood-red heads, = var. *sanguiniceps* Donis.

*Distribution*.—Tropical Africa, Egypt, Arabia, India, Indochina, Ceylon.

28. *Camponotus (Orthonotomyrmex ?) puniceps*, sp. n.

♀. Head, thorax, pedicel, coxæ and trochanters reddish pink, antennæ and spurs reddish yellow, anterior pair of legs brownish red, posterior pairs of legs and gaster black.

Clothed with long outstanding golden hairs, head and thorax with silvery pubescence which does not obscure the puncturation, gaster with rather close decumbent golden hairs or pile. Anterior tarsi furnished with rather close golden bristles beneath, posterior pairs with not so close reddish bristles above and beneath, posterior tibiae with a row of black bristles or spines beneath.

The puncturation of the head, body and legs is similar to that of *sericeus*, being of a close granular nature.

Head slightly shorter in proportion to its breadth than in *sericeus*. Meso-epinotal suture deeper and more marked; epinotum excised in centre of basal border, posterior angles bluntly pointed, sides strongly ridged, the surface beneath the ridges being considerably hollowed out; pedicel furnished with a scale rather than a node, apex narrowed and rounded, anterior surface slightly concave and sloping, posterior surface upright, slightly convex; gaster as in *sericeus*.

Long. 8.5 mm.

Described from nine workers. Dohnavur, 350 ft., Tinnevely District, S. India, 1. x. 38.

Type in B.M. (N.H.).

This handsome species comes quite close in general appearance to *C. (O.) sericeus* F., but the epinotum and pedicel are quite different.

It does not agree with Emery's interpretation of the subgenus *Orthonotomyrmex*, for the scale is not low, nor has it the form of a round node. On the other hand, it does not fit into any of the other subgenera, in which he says the scale is thick or thin but never nodiform.

It does not seem practical to make a new subgenus for this insect.

29. *Polyrhachis (Campomyrma) exercita* Walker, Ann. Mag. Nat. Hist. (3), iv. p. 370 (1859) = *clypeata* Mayr, Verh. Zool. Bot. Ges. Wien, xii. p. 683 (1862); Donisthorpe, Ann. Mag. Nat. Hist. (10) ix. p. 576 (1932).

Eleven ♂♂. Dohnavur, 350 ft., Tinnevely, S. India, 1. x. 38. All these specimens have dark legs.

*Distribution*.—India, Ceylon.

30. *Polyrhachis (Myrmothrinax) thrinax* Roger, Berl. Ent. Zeits. vii. p. 152 (1863).

Seventeen ♂♂. Nadungayam, 200 ft., Malabar, S. India, 16-22. ix. 38.

*Distribution*.—S. India, Bengal, Ceylon, Burma, Java.

31. *Polyrhachis (Myrmothrinax) thrinax* Roger, var. *mucronis*, var. n.

In this variety the central spine on the petiole is simple instead of being bimucronate as in the typical form.

Seven ♀♀. Nadungayam, 200 ft., Malabar, S. India, 16-22. ix. 38.

32. *Polyrhachis (Myrmhopla) tibialis* Smith, Cat. Hym. Brit. Mus. vi. p. 63 (1858).

Two ♂♂, one w. ♀. Tenmalai, 500-800 ft., Travancore, S. India, 11-17. x. 38; 1 ♂, Nadungayam, 200 ft., Malabar, S. India, 16-22. ix. 38.

*Distribution*.—India, Burma.

33. *Polyrhachis (Myrmhopla) tibialis* Smith, var. *parvis* Emery, Ann. Mus. Stor. Nat. Genova, xl. p. 717, nota (1901).

One ♂. Nadungayam, 200 ft., Malabar, S. India, 16-22. ix. 38.

*Distribution*.—S. India, Ceylon.

34. *Polyrhachis (Myrmhopla) binghami* Forel, Journ. Bombay Nat. Hist. Soc. viii. pp. 25, 33 (1893).

Three ♂♂. Tenmali, 500-800 ft., Travancore, S. India, 11-17. ix. 38.

*Distribution*.—Burma.

35. *Polyrhachis (Myrma) illaudata* Walker, Ann. Mag. Nat. Hist. (3) iv. p. 373 (1859); Donisthorpe, Ann. Mag. Nat. Hist. (10) ix. p. 576 (1932)=*mayri* Roger, Verz. Formicid., p. 7 (1863).

Two ♂♂. Nadghāni Ghaut, Gudalur District, 3000 ft., S. India, 21. ix. 38.

*Distribution*.—S. India, Bengal, Ceylon, Indochina, Sonde Isle.

36. *Polyrhachis (Myrma) latispinosa*, sp. n.

♀. Black, clothed with close decumbent golden hairs, slightly more silvery in colour on head and thorax, and with long outstanding golden hairs. *Pronotal spines* long, sharp, pointing forwards; *epinotum* armed with very bluntly

pointed teeth; *scale* armed with four teeth, those on the upper lateral angles short, broad, but sharply pointed, those on the sides shorter and sharper. The space between the two upper teeth is produced in the centre into a very blunt, short, rounded tooth or projection, posterior surface of scale convex and somewhat rugose, anterior surface flatter and less rugose.

Wings yellow, pterostigma and veins yellowish brown.

Long. 10 mm.

Described from a winged female. Tenmalai, 500–800 ft., Travancore, S. India, 11–17. x. 38.

Type in B.M. (N.H.).

37. *Polyrhachis (Myrma) duodentata*, sp. n.

♀. Similar to *latispinosa* in size, colour, sculpture and clothing.

*Pronotal* spines the same; *epinotal* teeth somewhat sharper; the four teeth on the scale sharper and thinner, the space between the upper teeth produced in centre to form two short, small teeth.

Wings as in *latispinosa*.

Long. 10 mm.

Described from a winged female. Nadungayam, 200 ft., Malabar, S. India, 16–22. ix. 38.

Type in B.M. (N.H.).

These two species are very similar in appearance, and come near to *illaudata* Walker. They differ in not possessing long teeth or spines on the upper lateral angles of the scale, nor is the space between these teeth truncate as in that species. The *epinotal* teeth are more distinct (those of *illaudata* being distinctly rounded); the golden colour is not so deep; they are a little smaller and the gasters are less voluminous. From *proxima* Roger and *intermedia* Forel, besides not having the long teeth or spines on the upper lateral angles of the scale, they differ in not having the side teeth bimucronate. They are much too large to be the female of *convexa* Roger, which is similarly clothed, etc., in the worker.

38. *Hemioptica scissa* Roger, Berl. Ent. Zeits. vi. p. 240 (1862).

Fifteen ♂♂. Tenmalai, 500–800 ft., Travancore, S. India, 11–17. x. 38; Dohnavur, 350 ft., Tinnevely District, S. India, 8. x. 38.

Distribution.—Ceylon.

XXXVIII.—*A remarkable new Genus of Telenominæ*  
(*Hym.*, *Proctotrupoidea*, *Scelionidæ*). By G. E. J. NIXON,  
B.A., Imperial Institute of Entomology.

*NASDIA*, gen. nov.

♂, ♀.—Antenna 9-segmented with a well differentiated club in the female, but with a less sharply defined one in the male. Maxillary palpi 2-segmented; labial palpi 1-segmented. Eyes bare. Posterior ocelli touching the eye-margin. No trace of parapsidal furrows. Scutellum separated from the mesonotum by a curved crenate groove. Postscutellum completely concealed when the thorax is seen from above; in a lateral view it is completely overlapped by the posterior end of the scutellum. Propodeum medially with a strongly raised keel which, seen from above, shows as a short tooth (see fig. 3); each posterior corner of the propodeum is produced to form a blunt projection, hooked on its inner side. Venation of fore-wing much reduced, no differentiated marginalis, postmarginalis or stigmalis being present, the subcostalis terminating in a knob as in the *Inostemmini* (subfam. *Platygasterinæ*). Abdomen of typical Telenomine form.

Type of the genus: *Nasdia prosper*, sp. n.

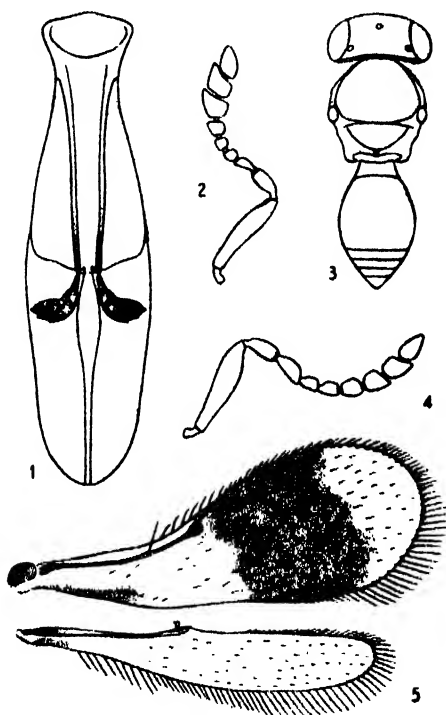
*Nasdia prosper*, sp. n.

♀.—Head black except for a large testaceous-yellow patch between the eye and the mandible; thorax black; abdomen bright yellow. Antennæ brownish. Front and middle coxæ, front and middle femora brownish; hind legs yellow throughout. Wings with a well-marked brownish-yellow tint.

*Head* strongly transverse, cut away behind the eyes more or less at right-angles to the long axis of the body, so that the eyes occupy the entire lateral surface of the head. Frons smooth and shining. Postorbital carina extended as a sharp, completely differentiated margin right across the vertex, behind the posterior ocelli; surface of the vertex anterior to the margin not quite smooth, there being traces of scaly-reticulation. Club of the flagellum rather sharply defined, segment 4 being much nearer in size to 3 than to 5 (fig. 2).

*Thorax* only a trifle longer than wide, 7:6. Mesonotum in front showing a little roughness of surface but in far

greater part smooth and shining; along each side, following more or less the course of the parapsidal furrows, if such were present, is a row of about 8-10 sharply defined, rather large punctures. Scutellum smooth, shining, transverse, separated from the mesonotum by an evenly curved crenate furrow. Postscutellum very



*Naedia prosper*, gen. et sp. nov.

Fig. 1.—Genitalia of ♂.

Fig. 2.—Antenna of ♀.

Fig. 3.—Body of ♀.

Fig. 4.—Antenna of ♂.

Fig. 5.—Wings of ♂.

narrow, not readily visible and, in a lateral view of the thorax, lying below the scutellum and completely over-reached by it. Keel of the propodeum in a lateral view showing as an angular lamella, almost straight above and posteriorly; sides of the propodeum dorsally, finely,



very indistinctly, pubescent. Legs moderately slender, but the hind femur rather strongly swollen.

*Abdomen* as in figure 3; tergite 2 costate only at extreme base.

♂. Strikingly unlike the female in colour, the abdomen being brown to very dark brown with only tergite 1 and the extreme base of 2 reddish or yellowish red. Hind femora brownish like the other pairs. Fore wings with a large brownish cloud in the middle (fig. 5).

Flagellum thickened towards apex but without a clearly differentiated club (fig. 4). Genitalia (fig. 1).

Length : ♂ ♀, .65 mm. approx.

FIG. 1s. : Lami, 10. viii. 1940, 19 ♀♀, one the type, 17 ♂♂, bred from *Pseudococcus* sp. (presumably from the eggs!) (R. A. Lever). Type in B.M.

The 9-segmented antenna and the reduced venation, in combination with the simple abdomen, make this a remarkable insect and one about whose subfamily position I have been in much doubt. In order to reach a decision, much depended on the value to be attached to each of these features. I know of no genus in the Telenominæ in which the antenna has less than 10 segments or of one in which the venation shows even an approach to what occurs in *Nasdia*. On the other hand, both these characters occur singly and together in the tribe Inostemmini of the related subfamily Platygasterinæ. Against this has to be considered that the form of the abdomen of *Nasdia* occurs throughout the entire subfamily Telenominæ and is indeed the latter's chief characteristic, whereas the abdomen of the Platygasterinæ is of an entirely different type and in its conformation equally characteristic. I have accordingly preferred to place the emphasis on this last-mentioned feature in placing *Nasdia* among the Telenominæ, but I am by no means sure that this does not involve an unjustifiable extension of the limits of the subfamily. Perhaps it may be found desirable later to place the genus in a new subfamily.

Typical Telenomine features of *Nasdia* are its general facies, the shape of the head, position of the posterior ocelli and the broad fore wing with its long marginal cilia. A unique feature of the genus is the shape of the propodeum.

The genitalia of the male appear to be like those of *Telenomus*.

FIG. 1.



FIG. 2.



FIG. 3.



Fig. 1.—Scale of *Polyrhachis (Myrma) latispinosa*, sp. n., posterior view.

Fig. 2.—Scale of *Polyrhachis (Myrma) duodentata*, sp. n., posterior view.

Fig. 3. Scale of *Polyrachis (Myrma) illaudata* Walker.



# THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 55. JULY 1942.

XXXIX.—*Pleistocene Murinæ from Palestine.*  
By DOROTHEA M. A. BATE.

## *Introduction.*

The remains of fossil Murinæ with which this note deals form part of the great collection of Pleistocene mammalia obtained during the excavation of the Wady el-Mughara caves undertaken by a joint expedition of the British School of Archæology in Jerusalem and the American School of Prehistoric Research, with Professor D. A. E. Garrod as Field Director (Garrod, 1937). A general account of the animal remains, with descriptions of many of the species, was published in 1937 (Bate, 1937), but at that time it was not possible to study all the groups in detail. Since then an account has been given (Bate, 1940) of the Natufian (Mesolithic) Antelopes, and recently it has been found possible to make a careful examination of the Murinæ. Remains of this group are not very numerous, but are of importance since they throw fresh light on the general history, past distribution, and former status in Palestine of the various species. The following eight forms have been distinguished:—

<i>Apodemus caesareanus</i> , sp. n.	<i>Arvicanthis ectos</i> , sp. n.
<i>A. levantinus</i> , sp. n.	<i>Rattus (Mastomys)</i> sp.
<i>Apodemus</i> sp. (large).	<i>Mus camini</i> , sp. n.
<i>Apodemus</i> sp. ( <i>mystacinus</i> group).	<i>Leggada</i> sp.

It will be seen that the four forms determined specifically have each proved to be distinct from any Recent or fossil species known, and it is probable that the other four will likewise prove to be distinct when a sufficient quantity of specimens is available for study. Two of the genera, *Arvicanthis* and *Leggada*, have not been previously recorded from Palestine. All the murine remains are from the Tabun Cave and come from Levels earlier than Level B, at which stage a faunal change had already taken place. No Murinæ are known from the deposits of M. Wad, all of which are more recent than Levels F to C of Tabun.

Tabun provides the earliest levels known from the Wady el-Mughara Caves, and their sequence is shown in the table, with the positions in which the species of Murinæ occur. The second column records the climatic conditions suggested by the faunal associations of the successive Levels. An account of these associations and a more detailed chart have been published (Bate, 1937). Professor Garrod (1937, p. 59) has given a list of the human industries found in the series of Levels tabulated in the table; these are Upper Acheulean in Level F; Upper Acheulean (Micoquean) in Level E; Lower Levalloiso-Mousterian in Levels D and C; and Upper Levalloiso-Mousterian in Level B. In a very interesting note on the chronology of Pleistocene sea-levels Dr. Zeuner (1938) has correlated the early part of Tabun E (a very thick deposit) with Riss 2, and its later part, together with Levels D and C, with the Riss/Würm Interglacial.

There seems to be no element among the fossil Murinæ to contradict the climatic inferences already drawn from the remainder of the Tabun fauna; in fact, some corroboration is added. For instance, the tiny mouse *Leggada* serves to emphasize the tropical nature of the climate of Level F, while the slightly later arrival and increase in numbers of the typically Palearctic *Mus* corresponds with similar activities of the Microtinæ.

The Levels F to C of Tabun attained an observed thickness of over 15 metres (Garrod, 1937), which must have required a long period of time for its accumulation. This is emphasized by the murine remains, for only one of the eight forms identified, *Apodemus caesareanus*, is known to have been present throughout these successive

Pleistocene Murinæ from Tabun Cave.		<i>Apodemus caesareanus.</i>	<i>A. levantis.</i>	<i>Apodemus</i> sp. (large).	<i>Apodemus</i> sp. ( <i>mylæus</i> group).	<i>Arviculhin ectus.</i>	<i>Rattus</i> ( <i>Mastomys</i> ) sp.	<i>Mus crinit.</i>	<i>Leggada</i> sp.
Level B	Climate with heavy rainfall, (†) lowered temperature. Faunal change.								
Level C	Warm and dry, permanent rivers .....	×	:	:	:	:	:	×	
Level D	Becoming drier. Fresh Asiatic immigrations ..... Some survivals from Level F,	×	×	:	:	:	:	×	
Level E	Warm and damp .....	×	×	×	×	×	×	(?)	
Level F	Damp and warm, perhaps tropical .....	×	:	×	:	×	×	:	×

levels. Of the five genera represented, likewise only one is known to persist; this is *Apodemus*, with four species, which are all associated in the transition from Level E-D. This associated specific abundance is remarkable, and seems to be unknown at the present day, although the presence of two species in a single locality is quite usual. Examples of this may be quoted from the Siberian Altai (Hollister, 1913) and from Mount Olympus, Thessaly (Chaworth Musters, 1932, p. 171). Among fossil records is the occurrence of two species of *Apodemus* in several stages of Neolithic levels in the *Raumgrotte* in the French Jura (Heller, 1932, p. 360).

At the present day the murine assemblage of Palestine differs considerably from that found in the early levels of Tabun. *Apodemus*, it is true, still occurs, but is chiefly restricted to the slopes of Mount Hermon, an area of greater altitude and more northerly latitude than Tabun. *Mus* of modern type is found in the country, and penetrates to the Jordan Valley. On the other hand, the desert-loving *Acomys* is plentifully represented by several species, and forms a conspicuous feature of murine population of the country. *Nesokia* of the Jordan Valley is a noteworthy Asiatic immigrant.

### *Description of Species.*

#### Genus *Apodemus* Kaup.

##### *Apodemus caesareanus*, sp. n. (Fig. 1, a & b.)

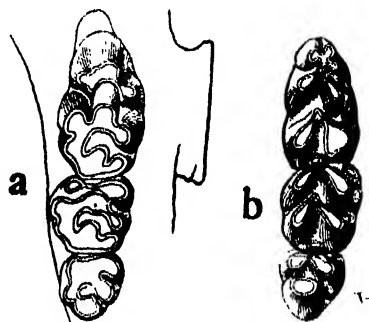
*Diagnosis.*—An *Apodemus* of the *A. sylvaticus* group; cheek-tooth rows about the size of those of *A. s. dichrurus* from Sicily, but zygomatic plate noticeably wider, the portion of the maxilla bearing the alveolar row, and also in front of tooth row, stouter. Width of palate and length of maxillo-palatines as in *A. s. dichrurus*. Incisive foramina wide, rounded posteriorly and penetrating backwards to behind the level of the anterior root of  $M^1$ .  $M^1$  narrow, with  $t1^*$  displaced somewhat further backwards than is usual in Recent *A. sylvaticus*, the three inner tubercles subequal in size, postero-external loop as in *A. s. dichrurus*, or with distinct supplementary tubercle. In  $M^2$   $t7$  is well developed and the outline of the enamel suggests the presence of a

\* For numbers of tubercles see Miller, 1912, p. 801.

postero-external tubercle besides  $t_9$ . Mandible comparatively stouter, both before and behind the cheek-teeth, than in Recent species; lower incisor robust, antero-posterior diameter actually greater than in the larger *A. flavicollis*. External tubercles in  $M_1$  and  $M_2$  large, and when slightly worn forming a cingulum. A small antero-external tubercle present in  $M_3$ , not evident in Recent species.

*Holotype*.—A right maxilla with zygomatic plate and  $M^{1-3}$ , from Level F of Tabun. Brit. Mus. M 15981 (fig. 1, a).

Fig. 1.



- a. *Apodemus caesareanus*, sp. n., holotype, M 15981,  $M^{1-3}$ , crown view,  $\times 10$ . Level F of Tabun.  
 b. *Apodemus caesareanus*, sp. n., M 15982,  $M_{1-3}$ , crown view,  $\times 10$ , Level F of Tabun.

*Locality and Horizon*.—Palestine: known from Levels F to C of Tabun. The holotype with fifteen other specimens from Level F associated with an Upper Acheulean industry; one specimen from Level Ea with an Upper Acheulean (Micoquean) industry; fourteen mandibular rami from the transition Level D–E, two from D, and one from C associated with a Lower Levalloiso-Mousterian industry.

*Description and Relationships*.—*A. caesareanus* is the only species of *Apodemus* known from the earliest mammal horizon of Tabun, Level F. The holotype is the only specimen which retains the complete cheek-tooth row, one other maxilla contains  $M^{1-3}$  and three others  $M^1$  only, all of these are from Level F. Level D–E has yielded



remains of four species of *Apodemus*, but since *A. caesareanus* is distinctly the smallest, there is not much reason to doubt the identification of the mandibular rami which represent the species in Levels later than F.

The small size of this species and the considerable reduction already attained by  $M^3$ , as well as the tooth pattern, show that this is an early form belonging to the *A. sylvaticus* group. The characters in which it differs from Recent forms are such as would be expected in a species of earlier geological age; among these are the strongly developed tuberculation of the cheek-teeth, the stouter skull and mandible, and the more robust lower incisors (the upper incisors are not yet known). In four examples the  $M^1$  has four roots, in the fifth there are five roots; in one specimen there is a distinct supplemental tubercle on the postero-external border. The crown length of the cheek-tooth row in the holotype is 4 mm., of which  $M^1$  occupies perhaps a little more than half. The greatest diameter of  $M^3$  is 1 mm. The skull characters distinguishing the earlier fossil *A. whitei* (Hinton, 1915, p. 580) are different in the corresponding parts of *A. caesareanus*.

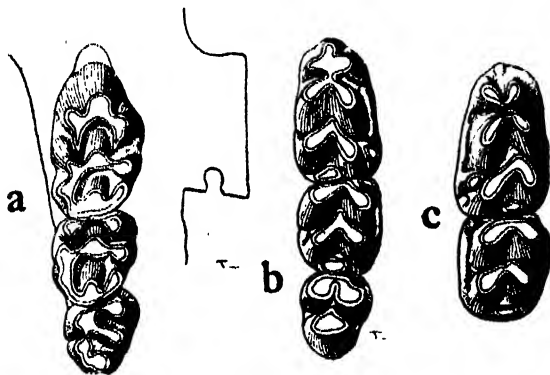
*Fossil Record*.—*A. sylvaticus* has been found in the Cromer Forest Bed and in later deposits in Britain (Hinton, 1915). A list of records from Bavaria and Hungary is given by Heller (1930, p. 268), and other records come from Pleistocene deposits in Hungary (Schaub, 1938), Switzerland (Stehlin, 1933) and Gibraltar (Bate, 1928). Most of these remains are in a fragmentary condition, and it is certain that further species will be distinguished when more complete specimens are available for study, as witness the recent discovery of *Parapodemus coronensis* in the Lower Pleistocene of Transylvania (Schaub, 1938, p. 37). Two specimens from Zuttiyeh were referred to *Apodemus*, but were not specifically determinable (Bate, 1927).

*Apodemus levantinus*, sp. n. (Fig. 2, a & b.)

*Diagnosis*.—An *Apodemus* of the *A. flavicollis* group; about the size of Recent *A. flavicollis* from Transylvania, but zygomatic plate higher and considerably wider, upper maxillary root of zygoma wider. The suture between the premaxilla and maxilla runs immediately

beneath the antero-inferior root of the zygomatic plate, that is, less forward than in Recent species. Incisive foramina wide, and rounded posteriorly, penetrating backwards to level with the anterior root of  $M^1$ . Width of palate as in *A. flavicollis*, maxillo-palatines very short.  $M^1$  narrow, its crown length slightly less than that of  $M^{2-3}$  owing to the size of  $M^3$ , which is noticeably larger than in Recent *A. flavicollis*. A postero-external supplementary loop present in  $M^1$ ,  $t9$  of  $M^2$  larger, and  $t1$  of  $M^3$  larger and occupying a more forward position than in Recent *A. flavicollis*.  $M_3$  with small antero-external tubercle, ramus stouter, and lower incisor shorter, with a smaller bony knob outside its place of origin than in *A. flavicollis*.

Fig. 2.



- a. *Apodemus levantinus*, sp. n., holotype, M 15991,  $M^{1-3}$ , crown view,  $\times 10$ . Level D-E of Tabun.  
 b. *Apodemus levantinus*, sp. n., M 15992,  $M_{1-3}$ , crown view.  $\times 10$ . Level D-E of Tabun.  
 c. *Apodemus* sp., M 15999,  $M_{1-3}$ ,  $\times 10$ . Level F of Tabun.

*Holotype*.—A right maxilla with the zygomatic plate and  $M^{1-3}$ , from Level D-E of Tabun. Brit. Mus. M 15991 (fig. 2, a).

*Locality and Horizon*.—Palestine: known from Levels Ea to D of Tabun and associated with Upper Acheulean (Micoquean) to Lower Levalloiso-Mousterian industries.

*Description and Relationships*.—The holotype is the only known example of a skull fragment and the upper cheek dentition of this species. The figured (fig. 2, b) and other mandibular rami are believed to represent this

species, but the identification is made with some reservation owing to the presence of a species only slightly larger in the same level (p. 473). In the holotype the zygomatic plate has a minimum width of 3 mm. and the maxillo-palatines have an antero-posterior length of only 2.1 mm.; the crown length of the upper cheek-tooth row is 4.5 mm. *A. levantinus* resembles specimens of Recent *A. flavicollis* from Transylvania more closely than any other species with which I have been able to compare it, nevertheless it differs from the Recent form in several important characters. For instance, the  $M^3$  of the fossil is noticeably larger, both actually and comparatively, the skull is shorter, the ramus stouter, and there is present in  $M_3$  a supplementary antero-external tubercle.

Turning to the fossil record, it seems that Tabun provides the earliest example known of the *flavicollis* group, for *A. lewisi* is from the Late Pleistocene fissure-deposit of Ightham, Kent, while Heller (1932, p. 361) found remains of *A. flavicollis* plentiful in early to late Neolithic levels in the Raumlöcher. In consonance with its later geological age, *A. lewisi*, which Mr. Hinton considers to be closely related to, if not identical with, *A. flavicollis* (1915, p. 582), differs from *A. levantinus* in having a decidedly smaller  $M^3$ .

The discovery of this form belonging to the *A. flavicollis* group in a comparatively early Level is of great interest, particularly in view of the occurrence of *A. caesareanus* of the *sylvaticus* group, both in the same and in an earlier Level; this seems to demonstrate conclusively that *A. flavicollis* has a distinct lineage from that of *A. sylvaticus*. Although *A. flavicollis* was originally described from Denmark by Melchior as long ago as 1834, it was for many years generally considered to be a form of *A. sylvaticus* (Barrett-Hamilton and Hinton, 1915, p. 545). At length Mr. Gerrit Miller (1912, p. 829) recognized it to be a distinct species, and in this he was supported by Mr. Hinton (1915), and later by many other authorities. It is not only morphologically that this distinction is evident, for while the habitats of these two species may approximate or overlap, they still retain their peculiar habits. An interesting light is thrown on this by an intensive piece of field work carried out in Poland by Dr. Heinrich (1928), who described the differences in their ways of life.

At the present day, according to Dr. B. Aharoni (1932), a single race of *A. flavicollis* is found in Northern Syria, and this author considers that Tristram's record (1884, p. 11) is erroneous. Dr. Bodenheimer (1935, p. 97), however, writes that three species of wood-mice are very common on Southern Hermon, and he lists them as *A. tauricus* (*sylvaticus* group), *A. pohlei* (a subspecies of *A. flavicollis*), and *A. mystacinus*. In any case it seems that *A. levantinus* provides the most southerly point of the known range of the *flavicollis* group.

*Apodemus* sp. (Fig. 2, c.)

Two mandibular rami from Level F, two from the top of Level E and one from the transition Level E-D represent an *Apodemus* distinctly larger than *A. caesareanus* or *A. levantinus*; larger also than the species described below, and believed to belong to the *mystacinus* group. Two teeth from one of these rami, Brit. Mus., M 15999, from Level F are shown in fig. 2, c; their combined length is 3.6 mm.,  $M_1$  being 2.3 mm. long, with a maximum width of 1.6 mm. The ramus in which these two teeth are retained is considerably stouter than that of the Recent *A. mystacinus*, and the incisor is large, with an antero-posterior diameter of 1.3 mm., a measurement surpassed by a specimen from Level D-E with a diameter of 1.7 mm. In the syntype of *A. mystacinus* the lower incisor has an antero-posterior diameter of 1 mm.

It is evident that there are European Pleistocene species of *Apodemus* of large size which are not yet adequately known or described. Dr. Schaub (1938, p. 34) has figured the  $M_1$  of two large forms from different deposits in Hungary, one of these (*op. cit.* fig. 17, e) is not very different from the Palestine specimen (fig. 2, c). Besides these, Dr. Stehlin (Stehlin and Dubois, 1933, p. 18) has recorded specimens of large dimensions from both France and Germany.

*Apodemus* sp. (*mystacinus* group).

Level D-E of Tabun has yielded a right maxilla containing  $M^1$ , Brit. Mus. M 15998, which represents a fourth species of *Apodemus* from this single level. It cannot be identified with *A. caesareanus* or *A. levantinus*,

and is much smaller than the form represented in fig. 2, c. It is believed to belong to the *mystacinus* group, which at the present day is known only from a comparatively restricted area, the Balkan Peninsula and Asia Minor, and probably Northern Palestine.

The basal portion of the zygomatic plate is preserved and has a width of 4.5 mm., which is much the same as in the Recent *A. mystacinus*, but is considerably wider than in *A. cæsareanus* and *A. levantinus*. The  $M^1$ , which has a postero-external supplementary tubercle, is broader, but otherwise resembles that of *A. mystacinus*. The maxillo-palatine is 2 mm. in length, that is, markedly longer than in the two named Tabun species, but shorter than in *A. mystacinus*. The hinder margin of the incisive foramina is parallel with a line drawn in front of the alveolus of  $M^1$ , and the posterior palatal foramina, advance to in line with the valley between  $t7$  and  $t4$  of  $M^1$ . As in *A. levantinus*, the suture between the premaxilla and maxilla runs immediately beneath the antero-inferior root of the zygomatic plate. This indicates a skull shorter than that of the Recent *A. mystacinus*, in which this suture occupies a more forward position.

Owing to there being only a slight difference in size between this fossil species and *A. levantinus*, it has not yet been possible to determine with certainty any of the lower dentition. This appears to be the first record of a fossil *Apodemus* of the *mystacinus* group.

#### Genus ARVICANTHIS Lesson.

*Arvicanthis ectos*\*, sp. n. (Figs. 3 & 4, a.)

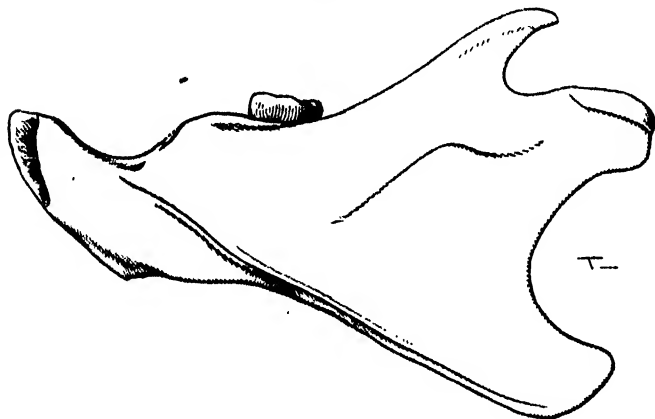
*Diagnosis*.—An *Arvicanthis* of rather small size, smaller than the holotype of *A. zaphiri* or *A. testicularis solatus*. Skull and mandible of slender build, dental border of maxilla deep. Zygomatic plate comparatively large, with anterior border not deeply excavated, palate narrow. Number of roots generally present in upper cheek-teeth greater than is found in Recent species. Upper cheek-teeth narrow compared with the length of the series, length of row in holotype 6.4 mm. Accessory tubercles strongly developed, a postero-external tubercle present in  $M^2$ .  $M^3$  long, the main lamina not transverse, but

\* From *ai ectos* = strangers.

slanting forwards externally, bent backwards on its outer border and, when worn, joining the small third lamina. Lower incisors narrow with comparatively thick enamel.

*Specimens*.—Eight portions of maxillæ, four with the complete cheek-tooth row, two with two cheek-teeth and two with only the anterior tooth. Fourteen mandibular rami with one or more cheek-teeth, one of which is shown in fig. 3, five with the incisor preserved. Also three mandibular rami with teeth which probably belong to this species, from Level E b of Tabun.

Fig. 3.



*Arvicanthis ectos*, sp. n., M 15965,  
left mandibular ramus,  $\times 4$ . Level F of Tabun.

*Holotype*.—A left maxilla with cheek-tooth row, Brit. Mus. M 15964 (fig. 4, a), from Level F of Tabun.

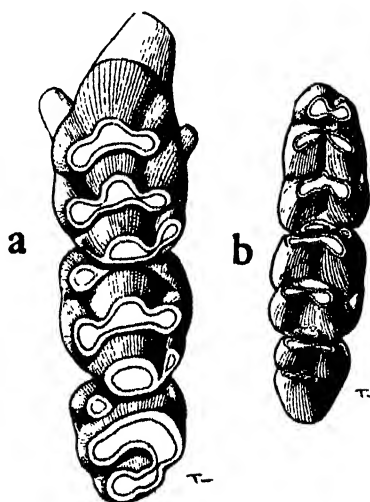
*Formation*.—Pleistocene: at present known from a cave deposit, and associated with an Upper Acheulean industry, Tabun, Level F; also from Level E b with an Upper Acheulean (Micoquean) industry.

*Distribution*.—Palestine: Tabun Cave, Wady el-Mughara, Mount Carmel.

*Description and Comparisons*.—The Palestine specimens have been compared with the corresponding parts of a number of Recent species of *Arvicanthis* from various regions of Africa, as well as forms of *Lemniscomys* and *Rhabdomys*, from each of which they show considerable

differences. Examples from Aden have not been available for comparison, but this is probably of little moment, since Mr. Oldfield Thomas found them to be indistinguishable from specimens of *A. testicularis* collected 110 miles south of Khartum (Thomas, 1901, p. 275). This opinion was reaffirmed by Captain Dollman (1911, p. 337)\*, who described the skull of the Sudanese species as large, with an upper molar series of 7.3 mm. This indicates a larger animal than *A. ectos*, in which this measurement

Fig. 4



- a. *Arvicanthia ectos*, sp. n., holotype, M 15964,  $M^{1-3}$ , crown view,  $\times 9$ . Level F of Tabun.  
 b. *Rattus (Mastomys)* sp., M 15978,  $M^{1-3}$ , crown view,  $\times 9$ . Level E b of Tabun.

ranges from 6 mm. to 6.4 mm. in the four specimens preserved. It is probable that the Palestine species resembles in size the smaller forms of *A. niloticus testicularis*, which range from the Anglo-Egyptian Sudan across to French West Africa. None of the Tabun mandibular rami are as large as those of the holotype

\* Since separated on external characters as *A. niloticus naso* Pocock, 1934,

of *A. testicularis centralis* from Bahr el Ghazal (Dollman, 1911, p. 338).

The three rami from Level E b of Tabun are larger than those from Level F, but otherwise do not show distinctive characters. In *A. ectos*  $M^2$  may have five or six roots, but the number does not seem to exceed five in Recent *Arvicanthis*.  $M^3$  in *A. ectos* likewise may have five or six roots, as compared with five in Recent *Arvicanthis*; in *Lemniscomys* the number is commonly three.

The fossil material shows that the most important characters which differentiate *A. ectos* from Recent *Arvicanthis* are the narrowness of the upper cheek-tooth row as compared with its length, the crown pattern of  $M^2$  and the comparatively great length of  $M^3$ . The comparative narrowness of the cheek-tooth row in *A. ectos* is similar to the proportions found in some species of *Lemniscomys*, such as *L. striatus venustus* from Nigeria and *L. dorsalis phæotis* Thomas from Kenya Colony. Although not quite the same, the pattern of  $M^3$  of *A. ectos* resembles more closely that of *Lemniscomys* than Recent *Arvicanthis*. The zygomatic plate in the Palestine species is fairly large, as in Recent *Arvicanthis*, not as in *Lemniscomys*.

*History and Distribution.*—According to present knowledge, the genus *Arvicanthis* and its allies *Rhabdomys* and *Lemniscomys* are, with one exception, confined to the continent of Africa, where they are widespread, and are plentiful in every suitable area. In his 'Checklist of African Mammals' Dr. Glover Allen (1939) cites 40 species and subspecies of *Arvicanthis*, 36 of *Lemniscomys* and 12 of *Rhabdomys*. The single geographical exception already mentioned above is a form of *A. testicularis* found plentifully in the neighbourhood of Lahej, near Aden (Thomas and Yerbury, 1895, p. 553).

The Palestine specimens just described provide, I believe, the first record of a fossil species of *Arvicanthis* as well as the first authenticated record from Palestine. The question of the occurrence of *Arvicanthis* in Palestine and Transjordan at the present day will probably only be satisfactorily settled after an exhaustive zoological survey has been made of these two countries. Tristram (1884, pp. 11, 41) listed *Mus variegatus* Licht., by which



name he evidently referred to an animal other than *Acomys*. The record, however, is not of much value, since it was made only on hearsay. In his Catalogue Trouessart (1898-9, p. 497) gives Tristram as the authority for the occurrence of *Arvicanthis* in Palestine, and he repeats the record in the Supplement (1904-5, p. 387). As recently as 1930 Dr. J. Aharoni, in a paper on the Mammals of Palestine (1930, p. 338), includes *Mus variegatus* Licht., which, he says, is apparently rare, and only found in the Southern Steppe. Meanwhile, in 1895, Mr. Oldfield Thomas (1895, p. 553) described *Arvicanthis* from near Aden, which he believed to be "the first recorded instance of the occurrence of this genus, . . . off African soil." This author seems, therefore, to have had no confidence in the reported presence of *Arvicanthis* in Palestine. In her Monograph on the Recent Muridæ of Palestine Dr. B. Aharoni (1932) does not include *Arvicanthis* in her list of species. She is followed in this respect by Dr. Bodenheimer (1935, pp. 96-7).

*Habits and Climatic Inferences.*—The Recent *Arvicanthis* near Aden is "found plentifully in the ditches separating the fields—in fact anywhere where the tall rank grass grows; it does not appear to venture into the desert, . . ." (Thomas, 1895, p. 553). Major Stanley Flower (1932, p. 412) refers to *A. niloticus* as the common field rat of Upper Egypt and the Fayum, and mentions that it is found along canal banks and on the edge of cultivation. *L. barbarus* in Equatorial Africa was said by Emin Pasha to be "found along the edges of the forest" (Thomas, 1888, p. 11). In writing of the Striped Rats of South Africa, Fitzsimons says (1920, p. 140): "The habits of all these local races of the Striped Rat are more or less similar. They are found wherever there is suitable cover in the shape of thick tussocks of grass, brushwood, scrub and bush, usually in the neighbourhood of water."

Thus we see that *Arvicanthis* is the reverse of a desert dweller, and is an animal requiring a habitat which contains permanent water and vegetation, but localized supplies would probably be sufficient. At the present day the genus occurs only in warm areas.

*Summary.*—It is not surprising, in view of its geological age, that *A. ectos* does not conform exactly with the

Recent *Arvicanthis* as re-defined by Mr. Oldfield Thomas (1916, p. 68), although it seems necessary to include it in this genus for the present. To sum up, *A. ectos* is a generalized form, allied to the *A. niloticus testicularis* group, while at the same time showing some affinity with *Lemniscomys*. It is significant that the Recent Arabian species is also one of the *A. n. testicularis* group; possibly this group is descended from *A. ectos*. This would be an interesting ancestry for animals which are so pre-eminently African at the present day.

### Genus RATTUS Linnæus.

*Rattus (Mastomys* Thomas) sp. (Fig. 4, b.)

*Description.*—A single imperfect right mandibular ramus containing the full complement of teeth (Brit. Mus. M 15978) from Level E b of Tabun was at first sight thought to represent a species of *Lemniscomys* on account of its narrow cheek-tooth row. A closer examination showed that the shape of the incisor ruled this out, for the incisors in *Arvicanthis*, *Rhabdomys* and *Lemniscomys* all have a comparatively broad and nearly flat anterior surface. The fossil exhibits a gently rounded anterior surface to a tooth which is narrow from side to side, and as a whole very slight compared with the incisor of a *Rhabdomys* or *Lemniscomys* with an even smaller cheek-tooth row than that from Palestine.

A search was then made through the large series of types of Recent *Rattus* and its allies in the collection of the British Museum (Natural History), which includes many forms from both Asia and Africa. From Asia there are some rats with a mandible as small, or almost as small, as the Palestine specimen, and mention may be made of *Rattus ling*, *R. lepcha* and *Millardia dunni* and others; these, however, also differ from the fossil in having an incisor with a wide and almost flat anterior surface.

The African continent is particularly rich in the smaller species of *Rattus*, and it was soon found that the Palestine fossil was closely matched by forms of the *R. coucha* group which was separated as a subgenus, *Mastomys*, by Mr. Oldfield Thomas (1915, p. 477), and subsequently as a genus by the original author and

others. Sir John Ellerman, who is the latest to monograph the Recent Murinæ, prefers to retain *Mastomys* as a subgenus of *Rattus*, embracing 28 forms (Ellerman, 1941, p. 211).

The Palestine fossil shows slight but consistent differences from the corresponding part of the various forms with which it has been compared, and it is probable that when more complete specimens are obtained it will prove to represent a distinct species. The cheek-tooth row of the Tabun ramus has a length of 4.7 mm., which is practically the same as in the holotype of *Mastomys azrek* \* from the Blue Nile region. These two specimens are in a similar stage of wear and, therefore, suitable for comparison; the crown pattern is similar except that there is a slight cingulum on the external border of  $M_2$  in the Recent form, and that this tooth is wider in the fossil. The cingulum is even more strongly marked in  $M_2$  in the holotype of *M. coucha coucha* from South Africa. The incisor from Palestine is similar in shape to that of *R. (M.) azrek* and other forms of *R. coucha*, but it is more massive both in width and antero-posterior diameter; this is no doubt a primitive character. The fossil ramus is slightly more massive than in Recent forms.

In writing of the African rats of the "*coucha*" group Sir John Ellerman recently made the interesting remark that "... the present group may be one of the primitive lines that may have given rise to *Mus* on one hand, or part of *Rattus* on the other" (Ellerman, 1941, p. 169).

*Distribution and Horizon.*—The same writer (Ellerman, 1941, p. 169) gives as the range of the *coucha* group "... Morocco, Gambia, Gold Coast, Nigeria, Sudan, Abyssinia, Kenya, Uganda, Tanganyika, South-west Africa and South Africa." Thus it is seen that at the present day *Mastomys* is confined to the African continent. Recently the first discovery of fossil remains in the Nagri formation of the Siwalik series in India greatly extended the known range of the genus (Lewis, 1939). The Palestine specimen from a much later deposit is an interesting geographical link.

\* *R. (M.) azrek* (Wroughton), is said to be a synonym of *R. coucha macrolepis* Sundevall (see Ellerman, 1941, p. 213).

The unique specimen of *R. (Mastomys)* sp. was obtained from Level E b of Tabun Cave, where it was associated with an Upper Acheulean (Micoquean) culture. This level contained a rich fauna (Bate, 1937, p. 145) which included a number of extinct forms, some, like *Philistomys roachi* and *Crocidura samaritana*, surviving from the earlier Level F.

*Habits*.—Captain Shortridge (1934, I. pp. 301–2) has brought together a number of accounts of the habits of the *coucha* group of rats. His own remarks are that it "... is generally widely distributed, except on the slopes of arid mountains or on bare waterless plains. It collects in large numbers around vleis, in patches of rank grass, or in dense bush, and appears to prefer the vicinity of water." An animal of these habits would be at home in the climate suggested by the known faunal complex of Level E of Tabun, "a warm, damp climate, growing somewhat drier, with mixed fauna, survivals from Level F" (Bate, 1937, chart facing p. 156).

#### Genus *Mus* Linnæus.

##### *Mus camini* \*, sp. n. (Fig. 5, a.)

*Diagnosis*.—A *Mus* less specialized than Recent *M. musculus* and its near allies, more specialized than *M. minotaurus*; size rather larger than Recent *M. musculus*, smaller than *M. minotaurus*. Length of  $M^1$  slightly more than the combined lengths of  $M^{2-3}$ ,  $M^1$  narrow, and internal tubercles not strongly salient, anterior root not noticeably projected in front of the crown. A substantial  $t_3$  present in  $M^2$ .  $M^3$  comparatively larger than in Recent species, with massive roots. Mandibular ramus comparatively shorter than in Recent species, both in front of and behind the tooth row, length of condyle noticeably less. Lower incisors stout, and enamel fold on outer side very wide. Antero-external tubercle present in  $M_2$ .

*Holotype*.—A left maxilla and zygomatic plate with  $M^{1-3}$  (Brit. Mus. M 15957), from Level D–E of Tabun Cave (fig. 5, a).

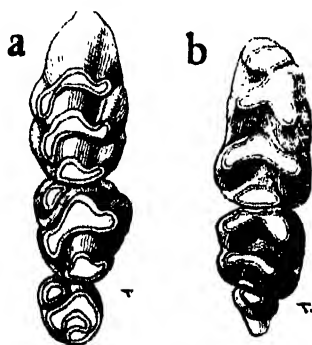
*Locality and Horizon*.—Palestine: at present known from the Tabun Cave, Wady el-Mughara, obtained from

\* *camini* = of the Oven; Tabun = Cave of the Oven.

Levels E b to C of this cave, and associated with Upper Acheulean (Micoquean) and Lower Levallois-Mousterian industries.

*Description and Comparisons.*—Only about 30 specimens of *M. camini* are known, and 20 of these, including the holotype, are from the transition Level D-E. There is considerable range in size among the mandibular rami, and it is possible that more than one species may be represented.

*Mus camini* is at once distinguished from Recent species by the comparative shortness of  $M^1$ , which is very little longer than  $M^{2-3}$  together. The holotype tooth row has a crown length of 3.5 mm., of which  $M^1$  occupies 1.9 mm. and  $M^{2-3}$  1.6 mm. The suture between



a. *Mus camini*, sp.n., holotype, M 15957,  $M^{1-3}$ , crown view,  $\times 10$ . Level D-E of Tabun.

b. *Leggada* sp., M 15979,  $M^{1-3}$ ,  $\times 15$ . Level F of Tabun.

the premaxilla and the maxilla runs almost immediately beneath the antero-inferior angle of the zygomatic plate in *M. camini*, whereas its position is noticeably further forward in Recent species such as *M. gentilis*, *M. musculus*, *M. wagneri* and *M. spretus*. In *M. camini* the distance between the anterior basal origin of the zygomatic plate and the anterior border of the alveolus of  $M^1$  equals the length of  $M^1$  and a third of that of  $M^2$ , that is, comparatively longer than in *M. minotaurus*, but not so long as in *M. spretus* or *M. gentilis*. These two characters

suggest that *M. camini* was shorter snouted than modern forms.

The width of the zygomatic plate in the Palestine fossil is 2.6 mm.; its anterior border is excavated ventrally and then sweeps outwards and upwards, sloping backwards some distance before its highest point is reached. The plate is comparatively low, considerably lower than in the holotype of *M. spretus* from Algeria in the British Museum collection. The palate is wide; the width from behind  $M^3$  to the central line equals the crown length of  $M^1$ . In  $M^1$  of *M. camini*  $t1$  is displaced further backwards than in *M. minotaurus*, but not so far as in Recent species; the anterior root of this tooth projects slightly in front of the crown, but less than usually occurs in Recent species.  $M^2$  of *M. camini* has a distinct  $t3$ ; this is commonly absent in Recent species, though it may be seen in *M. bactrianus* and *M. wagneri*. The comparatively large  $M^3$  has massive roots, not abruptly separated from the crown as in most Recent forms; its antero-internal tubercle ( $t1$ ) is large.

The length of the lower cheek-tooth row is 3.5 mm., and  $M_1$  barely equals in length  $M_{2-3}$ . The incisor is stout, with an antero-posterior diameter of 1 mm., of which half is occupied by the enamel fold on the external surface. There is a distinct antero-external tubercle in  $M_2$ ; this is generally absent in Recent *M. musculus*, but may be seen in *M. bactrianus* and *M. wagneri*.  $M_3$  is comparatively larger, and its second lamina less reduced than in Recent species.

*Remarks.*—*M. camini* is the first fossil *Mus* to be recorded from Palestine. It seems to represent a stage of development or specialization between that of *M. minotaurus* from Crete and Recent forms. This intermediate position is shown, for instance, in the comparative lengths of the upper cheek-teeth, the degree of distortion of the first lamina of  $M^1$ , and by the position of the zygomatic plate.

Dr. B. Aharoni (1932, p. 184) records two races of *M. musculus* as living in Palestine at the present day.

*Fossil Record.*—Very little is known of the immediate ancestry of *Mus*, and the few published records have recently been mentioned in connection with the description of *M. minotaurus* from Crete (Bate, 1942).

Genus *LEGGADA* Gray.*Leggada* sp. (Fig. 5, b.)

Three mandibular rami from Level F of Tabun represent a pygmy mouse of diminutive size, such as is seen only in a few species belonging to this genus, for instance *L. bella* from Kenya, *L. tenella* from the Sudan, *L. haussa* from Nigeria, and *L. deserti* from Bechuanaland. Two of the three rami contain the three cheek-teeth, and two retain the incisor. Unfortunately these few specimens are insufficient for specific determination, although the powerful incisor, with its wide outer enamel band, suggests that the Palestine mouse will prove to be a species distinct from Recent forms.

In the figured specimen (Brit. Mus. M 15979) the length of the cheek-tooth row is 2.3 mm., of which 1.4 mm. is occupied by  $M_1$  and 0.9 mm. by  $M_{2-3}$ , that is to say, the anterior tooth is more than one and a half times the combined length of the hinder ones, a condition of greater specialization than in Recent *Mus musculus*. The pattern of the cheek-teeth is shown in fig. 5, b, and the dwarfed size of the peg-like third molar with its large single root is noticeable. This excessive reduction of the third molar is otherwise found only among the African members of this group of pygmy mice, and it seems possible that they will eventually have to be separated generically from the Oriental forms. In the Indian, as well as some African, species,  $M_3$ , although greatly reduced, is still composed of two laminae.

The present is the first record of a fossil *Leggada* from Palestine, and the genus is unknown in the country at the present day. The discovery is even more interesting than this, for it seems to provide proof of the generic distinction of the Recent *Mus* and *Leggada*, for here we have a *Leggada* from Level F already in a condition of greater specialization than that of *Mus camini*, which is found in later horizons.

The only known fossil species which may perhaps be related to the Palestine *Leggada* is *Leggadilla platythrix*, recorded, with some doubt as to its geological age, from the Karnul Caves (Lydekker, 1886, p. 36). This species is much larger than the Tabun fossil, and its

$M_3$  has two roots, is comparatively larger, and is composed of two laminae.

This note would not be complete without an expression of gratitude to Mr. M. A. C. Hinton, F.R.S., for giving me free access to the splendid collection of types of Murinæ in the Department of Zoology: and also for Sir John Ellerman's recent work on living rodents, which has been particularly helpful at a time when library facilities are necessarily restricted. Once more I am deeply indebted to Mr. Terzi for a series of beautiful and illuminating drawings.

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**XL.—The British Species of the Genus *Ecdyonurus* (*Ephemeroptera*). By D. E. KIMMINS, Department of Entomology, British Museum (Natural History).**

THE genus *Ecdyonurus* was proposed by Eaton in 1868 (*Trans. Ent. Soc.* p. 142, footnote), with genotype *Ephemerella venosa* Fabricius, 1775, but in the same year (*Ent. Mon. Mag.* v. p. 90) he suppressed it as a synonym of *Heptagenia* Walsh, at the same time pointing out that the name *Ecdyonurus* was a mis-spelling of *Ecdyurus*. The International Rules (Art. 19), however, state that the original orthography of a name is to be preserved unless an error of transcription, a *lapsus calami*, or a typographical error is evident, and continental and American workers have mostly adopted the original orthography.

In 1881 (*Ent. Mon. Mag.* xviii. p. 25) Eaton reinstated

the genus, under the name *Ecdyurus*, but gave no specific names other than that of the genotype, although the proportions of the male fore tarsal segments given suggest that at least three species of this genus were known to the author. In 1885-7, in his Revisional Monograph of the Ephemeridæ, pp. 276-295, seventeen species are listed under the genus *Ecdyurus*, of which four (*E. venosus* F., *E. insignis* Etn., *E. volitans* Etn., and *E. lateralis* Curt.) are recorded as British.

In 1930 (Ent. Mon. Mag. lxvi. p. 56) Blair extracted *Ecdyonurus longicauda* Etn. (nec Steph.) as a valid species from the synonymy of *Ecdyonurus venosus*. At the same time he pointed out that there appeared to be at least two other species involved in the *venosus* complex in Britain, but that sufficient material was not then to hand to warrant definite separation.

Schoenemund (1930, Zool. Anz. xc. pp. 45-8, and Tierwelt Deutschl. xix. pp. 21-29) restricted the genus *Ecdyonurus*, transferring two of our species to the genus *Heptagenia* (*H. fuscogrisea* Retz. = *volitans* Etn., and *H. lateralis* Curt.), thus leaving three British species in the genus *Ecdyonurus* (*venosus*, *longicauda* and *insignis*). In 1935, Hincks and Dibb (J. Soc. Brit. Ent. i. pp. 75-76) published a note recording the probable addition of *E. forcipula* (Pict.) to the British list, based on the discovery of nymphal material answering to the description given by Schoenemund (1930).

Miss R. Rawlinson (1939, Proc. Zool. Soc. Lond. (B) cix. pp. 377-450) in her excellent paper on the life-history and breeding of *Ecdyonurus venosus* reviews the various specific characters which have been used and suggests that either (1) *venosus*, *longicauda* and *forcipula* are local varieties, races or seasonal forms which will be found to grade into one another, or (2) that the *Ecdyonurus* population of the stream upon which she was working is incompletely separated into the species described from elsewhere as distinct.

In considering the synonymy of the various species of *Ecdyonurus* on the British list, Dr. K. G. Blair drew my attention some time ago to a detail which has apparently been overlooked by most workers since Eaton, namely, that Curtis had described from the neighbourhood of Ambleside a *Baëtis dispar*, which species Eaton had

placed in the synonymy of *E. venosus*. Dr. Blair was collecting in the Lake District in June 1929, and on the shores of Windermere he took some examples of *Ecdyonurus* which were not *venosus*, and which he suspected might be *dispar* of Curtis. Curtis's types are in the National Museum, Melbourne, and a male specimen from the series taken by Dr. Blair was sent there for comparison. Mr. Clark replied that it was identical with the type. Recently I have had opportunities of collecting further material of this species from Windermere, and having examined males, females and subimagines, I believe it to be identical with *longicauda* Etn., 1871, the August or Autumn Dun. (As has recently been pointed out, *longicauda* Stephens, 1836, is a *Heptagenia*, and not identical with *E. longicauda* Etn., 1871, Blair, 1930, etc.) *Dispar* of Curtis is an earlier name than *longicauda* of Etn., and thus takes precedence.

Apart from the question of *E. dispar*, I have been studying the available material of the *venosus* complex in Britain, and here I must express my thanks to Dr. T. T. Macan, of the Freshwater Biological Association, who generously made available to me for study the material of this group which he had been accumulating for about two years. This material, much of it accompanied by nymphal exuviae, has been very helpful, as the habitat data are more detailed than one usually finds in museum collections. As a result of these investigations it seems that the *venosus* complex in Britain can be conveniently resolved into two species. Two of the specific characters used were not discussed by Miss Rawlinson in her paper. The proportions of the male front tibia to front tarsus were found to be reasonably constant, and in the seventy-odd specimens measured there was no overlap. In most cases the difference could be appreciated by eye, without the aid of measurements, as the increased proportion of the tarsus made the front leg look noticeably longer. The pattern of the subimaginal wing is rather less constant; *dispar* is easily separable, but the other two tend to grade into one another to some extent, and I have seen examples whose identity is somewhat doubtful.

The question next arises, To which of these two species (if either) should the name *venosus* Fabricius be applied? The species as interpreted by Eaton in his

Monograph was, we know, a composite one. Blair (1930), when reinstating *E. longicauda*, restricted *venosus* Fabr. to a form in which the cross-veins of the subimago were bordered with black. Mosely (1932), when dealing with the identity of the March Brown (*Rhithrogena haarupi* Esb.-P.), figured and described *E. venosus* Fabr., the False March Brown, as having the cross-veins of the subimago bordered with blackish but the coloration not forming definite bands arranged transversely across the wing, and the forceps-base of the male simple, not toothed. I have examined the continental material of *Ecdyonurus* in the British Museum and found there examples from several localities of one of the two British species in question, *E. venosus* of Blair and Mosely, but failed to find any of the other species. This latter species is very closely allied to *E. forcipula* (Pict.), but distinguishable from it by certain small characters in the male genitalia, and the nymph lacks the very definite white markings of the *forcipula* nymph figured by Schoenemund. It seems desirable, therefore, to accept as the true *venosus* Fabr. the species with simple forceps-base, proportions of the male front tibia to tarsus 1 : 1.5, subimaginal wings with the cross-veins bordered with blackish, giving a mottled, not banded, appearance. This restriction is in conformity with the definitions of Blair and Mosely, and works out to the name *venosus* in Schoenemund's key. As the other species does not appear to occur outside the British Isles, one may discount such synonyms of *venosus* as *Baëtis purpurascens* Pict. and *E. quæstor* Etn., and I am describing it as a new species.

I had expected to find Eaton's series of *E. quæstor* in the McLachlan collection, where much of Eaton's material is preserved, but all I could discover was a large male *dispar* from the Pyrénées Orientales over a label, in Eaton's handwriting, "*Ecdyurus longicauda* v. *quæstor*." Apart from the fact that the specimen is not one of the type series, the pattern does not agree with the description, the lateral stripes being very weak and obscure. The only Apennine specimens of *Ecdyonurus* in the McLachlan collection at the time of its purchase by the British Museum were over the label "*forcipula* Pict." and were a mixture of that species and *E. helveticus* Etn.

*Ecdyonurus venosus* (Fabricius, 1775).

(Figs. 1, 2 V, 3 V, 4.)

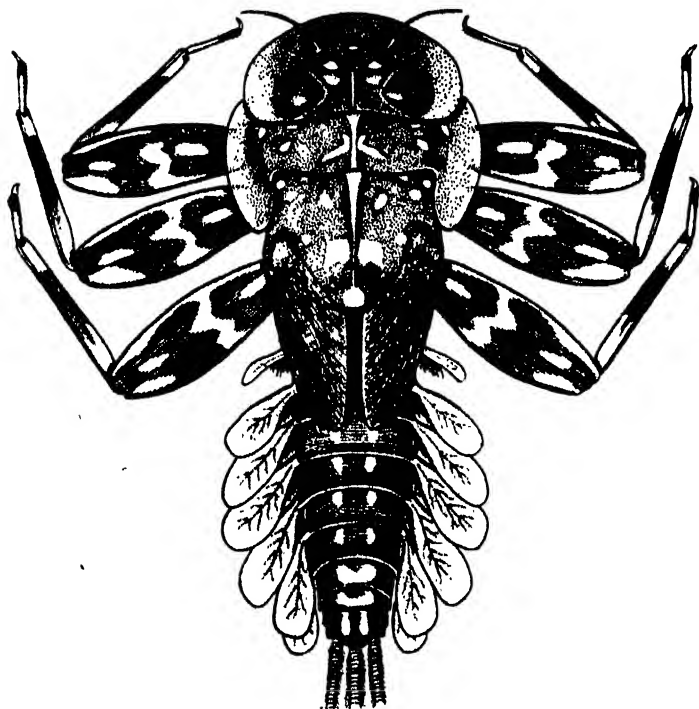
1775. *Ephemera venosa* Fabricius, Syst. Ent. p. 304.  
 1789. *Ephemera nervosa* Villers, C. Linn. Ent. iii. p. 22.  
 1836. *Baëtis venosa* Stephens, Ill. Brit. Ent. vi. p. 63.  
 1844. *Baëtis venosa* Pictet, Hist. Nat. Névr. ii., Ephém. p. 167.  
 1844. *Baëtis purpurascens* Pictet, op. cit. p. 174, pl. 20, fig. 4.  
 1863. *Baëtis montana* Hagen, Ent. Ann. p. 26 (partim).  
 1864. *Baëtis picteti* Meyer-Dür, Mitth. schw. ent. Ges. i. p. 121.  
 1868. *Ecdyonurus venosus* Eaton, Trans. Ent. Soc. Lond. p. 142, note.  
 1868. *Heptagenia venosa* Eaton, Ent. Mon. Mag. v. p. 90.  
 1871. *Heptagenia venosa* Eaton, Trans. Ent. Soc. Lond. p. 151 (partim), pl. 6, fig. 24.  
 1881. *Ecdyurus venosus* Eaton, Ent. Mon. Mag. xviii. p. 25.  
 1883. *Ecdyurus quasitor* Eaton, Trans. Linn. Soc., Zool. (2) iii. pl. 24, fig. 46 b.  
 1887. *Ecdyurus venosus* Eaton, op. cit. p. 283 (partim).  
 1887. *Ecdyurus venosus* var. *quasitor*, Eaton, op. cit. p. 286.  
 1909. ? *Ecdyurus venosus* Klapálek, Süßwasserf. Deutschl. viii. p. 29.  
 1929. *Ecdyonurus venosus* Ulmer, Tierw. Mitteleur. iv. p. 33, fig. 123.  
 1930. *Ecdyonurus venosus* Blair, Ent. Mon. Mag. lxvi. p. 56.  
 1930. *Ecdyonurus venosus* Schoenemund, Tierw. Deutschl. xix. p. 24, figs. 29-30.  
 1932. *Ecdyurus venosus* Mosely, Ann. & Mag. Nat. Hist. (10) ix. pp. 91-96.

♂ (dried).—Notum of thorax reddish-piceous. Dorsum of abdomen reddish-brown, apical margins of segments rather darker. Segments 2-8 marked at the sides with obscure reddish-purple triangles, a yellowish-brown area at the base of each segment above the spiracle. Pleuræ and sternites dull yellowish-brown. Forceps dark brown or piceous, forceps-base paler, its apical margin convex and usually without teeth. Lobes of the penis outspread, boot-shaped, rather slender. The outer sclerite truncate at its apex, which projects beyond the basal sclerite in the form of a small beak. Inner apical sclerites usually armed with two or three stout teeth, the sclerite projecting tailward and forming the heel of the boot. The out-turned portion of the basal sclerite slender, acute at its apex, the margin thickened to form a rim and set with a number of setæ. Caudal setæ fuscous, becoming apically and somewhat indistinctly annulate with fuscous. Fore leg dark reddish-fuscous, tarsus rather short (only 1.5 times as long as tibia), basal segment about half as long as second, but appearing shorter. Middle and hind legs yellowish-brown, tarsi pale fuscous. Wings vitreous, almost colourless, costal and subcostal areas often suffused with pale yellowish-green, especially near the base; pterostigma dark fuscous. Venation piceous, cross-veins in costal and subcostal area not weaker or paler than

elsewhere. Thickened area at base of anal veins in fore wing pale yellowish.

♀ (dried).—Notum of thorax reddish- or yellowish-brown. Abdomen reddish-brown, lateral stripes or triangles rather obscure. Subanal plate somewhat variable in outline, angularly produced at its centre, lateral margins also

Fig. 1.



*Ecdyonurus venosus*. Female nymph, mature.

obtusely angled. Setæ smoky brown at base, becoming paler apically, with indistinct annulations. Fore legs light reddish-brown, middle and hind legs yellowish-brown, tarsi sometimes fuscous. Wings vitreous, costal and subcostal areas paler than in male, pterostigma less marked.

*Subimago* (dried).—Membrane of wings colourless or pale yellowish-grey, venation reddish-brown or piceous,

cross-veins bordered with blackish-brown, the pigment not extending far on to the membrane, so that the general effect is one of mottling rather than the formation of transverse bands. The lateral abdominal stripes usually rather indistinct, as in the imago.

*Nymph*.—Sprawling, flattened dorso-ventrally, especially the head, the side margins of which in the mature nymph are usually rounded; eyes dorsal. Hind angles of pronotum strongly produced backwards. Seven pairs of lateral abdominal lamellæ, the first six pairs covering tufts of branchiæ. Three caudal setæ, pale yellowish-brown. General colour of nymph brownish or greenish-brown, with pale yellowish markings. Tarsi usually darker at apex, tarsal claw generally with two small teeth ventrally before the apex.

Length of anterior wing: ♂ 11–13, ♀ 12–16 mm.

Length of seta: ♂ 30–32, ♀ 22 mm.

*Distribution*.—DEVON: R. Bray, vi. 1932; R. Bovey, v.–3, vi. 1931; R. Teign, Newton Abbott, 26, v. 1931; East Lyn R., viii. 1899; Lustleigh, 28, iv. 1922; Dartmoor, Two Bridges, 10, 27, v. 1932. BRECON: Talybont-on-Usk, 16, v.–4, x. 1931; Brecknock Beacons, 900–1400 ft., 12, x. 1931. CARDIGAN: Tregarron, 13, vi. 1930. CAERNARVON: R. Llugwy, Capel Curig, vi. 1919. DERBY: R. Dove, iv. 1914. YORKS.: R. Wharfe, Bolton Abbey, 11–19, v. 1922. WESTMORLAND & N. LANCs.: Rydal Beck, 1, vi. 1941; Troutbeck, vi. 1940, 21, ix. 1941; R. Rothay, vi. 1940, 31, v. 1941; Black Beck, Hawkshead, vi. 1940. PERTH: St. Fillans, 6–18, vi. 1935. KINCARDINE: Auchanblae, viii.–ix. 1928. ARRAN: Slidery, viii.–ix. 1926. WICKLOW: Deputies Pass, 12, vi. 1933. ROSCOMMON: L. Key, 19–27, vi. 1913.

From the Continent I have seen examples from France, Switzerland and Slovakia.

The nymph of this species shows some preference for the larger fast, stony streams and rivers.

Imagines taken in the autumn are decidedly smaller than the spring hatch.

*Ecdyonurus torrentis*, sp. n. (Figs. 2 T, 3 T, 5.)

*Ecdyonurus venosus* auct., partim.

♂ (dried).—Eyes black. Notum of thorax dark reddish-brown. Dorsum of abdomen reddish-brown, segments

2-8 each with an oblique reddish-purple stripe arising at the spiracle and directed tailward and upward. Base of segment above stripe with a pale yellowish area, pleuræ also yellowish. Segments 9-10 dark reddish- or purplish-brown dorsally. Sternites paler than the tergites, without markings. Forceps dark brown, proportions of the segments somewhat variable, darker than the forceps-base, which bears a small but distinct tooth on the apical margin at each side. This tooth is usually smaller than in *E. dispar* and is not incurved as in that species. Lobes of the penis outspread, boot-shaped, somewhat blunter than in *E. venosus*. The outer sclerite does not overhang the basal in the form of a beak, and the inner apical sclerites do not project noticeably tailward. Outer apical margin of the basal sclerite rounded, not subacute and thickened into a rim as in *venosus*, but armed with a few setæ, some of the inner ones being set on small conical bases, but not definitely toothed as in *forcipula*. Denticulation of the inner apical sclerites variable, either a few teeth or numerous small bristles. Setæ fuscous, becoming slightly paler apically, indistinctly annulate with fuscous. Fore leg dark fuscous or piceous, basal segment of tarsus of normal proportions (about half as long as the second), tarsus about 1.8 times as long as the tibia (in *venosus* about 1.5 times as long). Middle and hind legs yellowish- or reddish-brown, femora with a small blackish streak on the outer surface at the apex. Wings vitreous, almost colourless, costal and subcostal areas not or very faintly suffused with yellowish; pterostigma fuscous, usually distinct. Venation piceous. Thickened area at base of anal veins in fore wing fuscous, not yellowish.

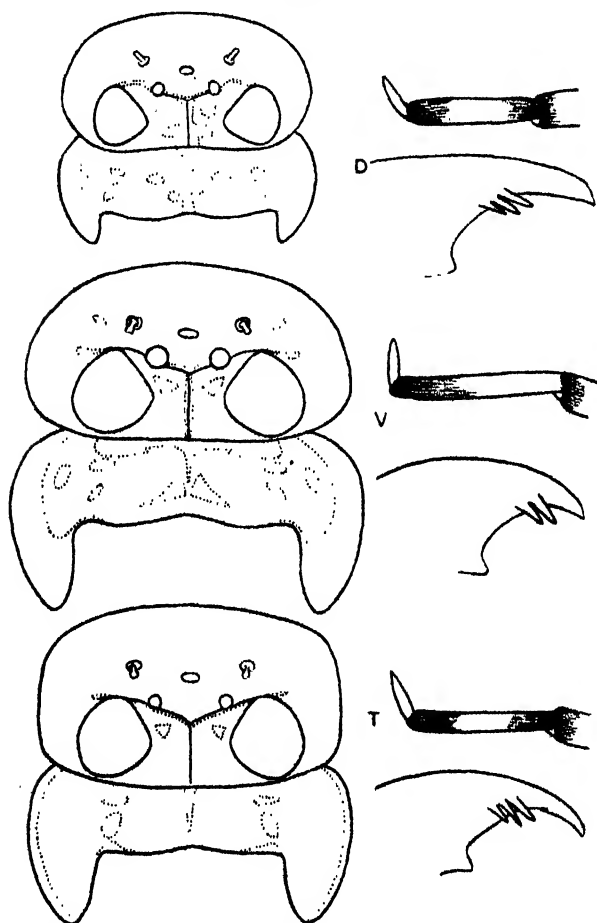
♀ (dried).—Notum of thorax yellowish- or reddish-brown. Abdomen yellowish-brown, with reddish-purple lateral stripes much as in the male. Subanal plate produced, somewhat variable in shape, its apex angular and each side with a very obtuse angle about midway. Setæ reddish- or yellowish-brown, paler apically, often with fairly distinct smoky annulations. Fore legs dark reddish-brown, middle and hind legs yellowish-brown. Wings vitreous, much as in male, but pterostigma less marked; thickened area at base of anal veins less distinct.

*Subimago* (dried).—Membrane of wings colourless or very pale grey, venation dark brown, cross-veins bordered with



dark brown, coloration tending to spread out over membrane in certain areas and to form well-marked transverse bands, particularly in the apical half of the

Fig. 2.



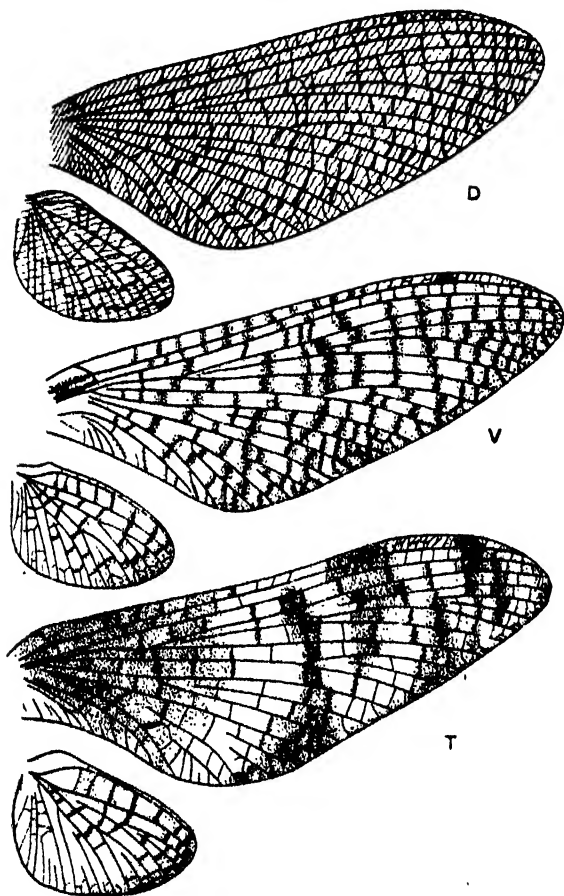
*Ecdyonurus dispar, venosus and torrentis*. Female nymphs, head, pronotum, fore tarsus, and tarsal claw.

wing. In *venosus*, the cross-veins are also bordered with brownish, but the coloration does not form transverse

bands, but produces a mottled effect. The abdominal oblique stripes can usually be seen quite clearly.

*Nymph*.—Similar in general appearance to *venosus*; the head of the full-grown nymph is more quadrate, the

Fig. 3.



*E. dispar*, *venosus* and *torrentis*. Subimaginal wing-pattern.

sides being somewhat flattened. Tarsi usually dark at base and apex, with a pale band between; tarsal claw generally with three small teeth ventrally before apex.

Length of anterior wing : ♂ 13-14, ♀ 14-15 mm.

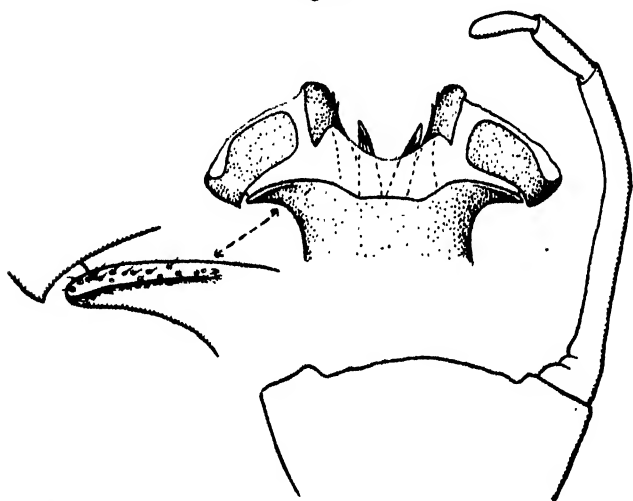
Length of seta : ♂ 32-35, ♀ 22-25 mm.

Type ♂, N. Lancs., Blelham Fishpond Beck, 20. v. 1941 (*D. E. Kimmins*). Allotype ♀, same locality, 12. vi. 1941 (*D. E. Kimmins*).

Type and paratypes in the collections of the British Museum (Nat. Hist.).

*Distribution*.—I have seen this species from ten British counties, and it is probably widespread wherever there are suitable streams. The nymph seems to have some

Fig. 4.



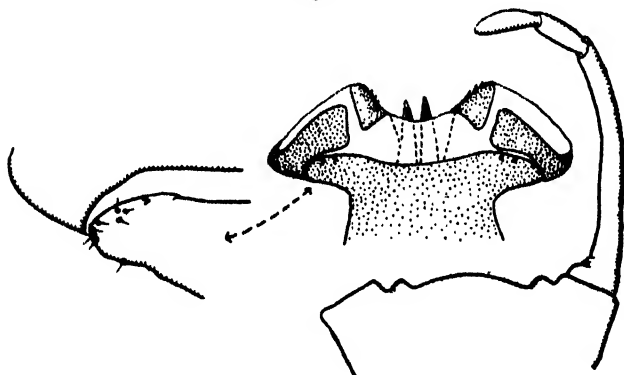
*E. venosus*, male. Forceps-base and right clasper, ventral; penis lobes, dorsal, more enlarged; outer portion of basal sclerite, further enlarged.

preference for the smaller stony becks rather than the fast stony rivers. DEVON : Braunton, vi. 1930 ; R. Otter, 26. vi. 1918 ; Newton Abbott, 14. vi. 1931. DORSET : Glanville's Wootton, 5. vi. 1868. SURREY : Witley ; Dorking district, 28. v. 1935. STAFFS. : Coombe Valley, 27. v. 1939. BRECON : Talybont-on-Usk, 7-12. vi. 1929, 6-15. vi. 1930, 16. v.-3. vi. 1931. LANCs. : Pendle Water, Roughlea, 7. vi. 1931. YORKS. : R. Ribble, Gisburn, 12. v. 31 ; R. Wharfe, Hebden, 20-24. v. 1933 ; R. Wharfe, Bolton Abbey, 4-14. v. 1921 ; R. Aire, above

Gargrave, 6. vi. 1925; Robin Hood's Bay, Mill Beck, 1. vi. 1925. WESTMORLAND & N. LANCS.: R. Kent vi. 1929, 22. vi. 1941; Hawkshead, Vicarage Beck, 5. vi. 1941, 23. vi. 1941; Blelham Fishpond Beck, 15. v.-12. vi. 1941; R. Winster, 8. vi. 1941; Nor Moss Beck, 3. v. 1941. PERTSHIRE: vi. 1922. ARGYLL: Portson-achan, 21. vi. 1935. DERRY: Moneymore, 5. vi. 1933.

I have not seen any examples of this species from the Continent, where it appears to be replaced by a closely allied species, *E. forcipula* (Pict.). In general appearance, *E. torrentis* is rather less heavily built than *venosus*, the fore legs of the male being noticeably longer. As far as

Fig 5.



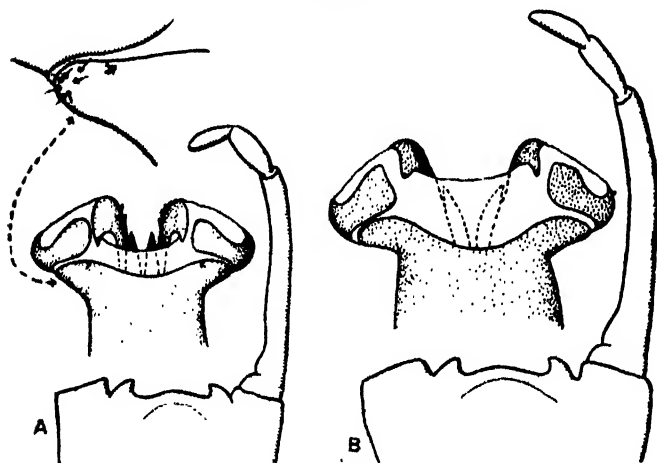
*E. torrentis*, male. Forceps-base and right clasper, ventral; penis lobes, dorsal, more enlarged; outer portion of basal sclerite, further enlarged.

present records go, it occurs only in May and June. Many of the smaller becks which it frequents in the Lake District either dry up or become very low during the summer, and this may perhaps prevent the development of a second brood in the autumn. Typical subimagines offer no difficulty in determination, but there are in the British Museum collection some subimagines from Talybont-on-Usk whose identity must remain somewhat doubtful in the absence of authentic imagines. I think there may be a tendency for the banding to fade a little after death or to become yellowish-brown.

*Ecdyonurus dispar* (Curtis, 1834). (Figs. 2 D, 3 D, 6, 7.)1834. *Baëtis dispar* Curtis, Lond. & Edinb. Phil. Mag. ser. iii. p. 120.1836. *Baëtis subfusca* Stephens, Ill. Brit. Ent. Mand. vi. p. 64.1871. *Heptagenia longicauda* Eaton (*neo* Steph.), Trans. Ent. Soc. Lond. p. 152, pl. 6, fig. 25.1887. *Ecdyonurus venosus* Eaton (*partim*), Trans. Linn. Soc., Zool. (2) iii. pp. 283-286.1929. ? *Ecdyonurus fluminum* Ulmer (*neo* Pict.), Tierw. Mitteleur. iv. p. 32, fig. 119.1930. *Ecdyonurus longicauda* Blair, Ent. Mon. Mag. lxvi. p. 56.1930. ? *Ecdyonurus fluminum* Schoenemund (*neo* Pict.), Tierw. Deutschl. xx. pp. 22-23, fig. 25.

♂ (dried).—Notum of thorax dark fuscous. Dorsum of abdomen fuscous, somewhat darker apically, from the side with the pleuræ and an area at the base of each segment above the spiracles paler and semi-transparent.

Fig. 6.



*E. dispar*, male. A, Arran, September; B, Windermere, June. Forceps-base and right olasper, ventral; penis lobes, dorsal, more enlarged; outer portion of basal sclerite, further enlarged.

No apparent oblique stripe or triangle as in the previous species. Sternites a little paler, with the impressed dots semi-transparent. Forceps dark brown, darker than the forceps-base, which bears on each side of the apical margin a strong tooth, somewhat incurved. Penis-lobes outspread, shorter and triangular rather than boot-shaped. Outer sclerite rounded at its apex. Inner apical sclerites

not projecting, either simple or armed with two or three teeth. Outer apical margin of the basal sclerite rounded, with a few bristles at the apex and sometimes also a small, inwardly-directed tooth. Setæ dark fuscous, becoming paler apically. Fore leg fuscous, basal segment of tarsus of normal proportions, tarsus about 1.8 times as long as tibia. Middle and hind legs reddish-brown, tarsi darker apically. Wings vitreous, almost colourless, costal and subcostal areas very slightly suffused with yellowish-brown, cross-veins in these areas usually weaker and paler than elsewhere. Cross-veins in the stigmal area thickened as in other species, pterostigma somewhat brownish, not very distinct. Venation and thickened area at base of anal veins in fore wing fuscous.

♀ (dried).—Notum of thorax reddish-brown. Abdomen bright reddish-brown, with rather indistinct purplish-red stripes arising obliquely from the spiracle on segments 2-8; pleuræ and an area at the base of each segment above the spiracle paler and translucent. Subanal plate much as in the other species. Setæ dark fuscous at base, paler apically, with indistinct annulations. Wings vitreous, with fuscous venation, costal and subcostal areas almost colourless, stigma indistinct. Costal and subcostal cross-veins before the stigma weak.

*Subimago* (dried).—Membrane of wings greyish-yellow, venation pale fuscous, the cross-veins very narrowly bordered with fuscous, but not to such an extent as to break up the uniformity of the ground-colour.

*Nymph*.—Similar in general appearance to *venosus*; the head of the mature nymph with the sides rounded, not quadrate. Produced hind angles of pronotum possibly shorter in proportion than in *venosus*. Setæ greenish- or yellowish-brown. Tarsi and tarsal claw much as in *torrentis*.

This nymphal description is based on material from Lake Windermere; I have no authentic material from streams, but I have taken nymphs from two localities, Scandale Beck and Stock Ghyll, both near Ambleside, which appear to be this species. The nymphs were at an earlier stage of development than *venosus* nymphs taken about the same date, and some of them would probably not be ready for emergence until the late summer.

Length of anterior wing : ♂ 10-13, ♀ 10-15-mm.

Length of seta : ♂ 22-30, ♀ 18-22 mm.

*Distribution*.—**CORNWALL** : St. Gennys, viii. 1932. **DEVON** : R. Taw, vi. 1912 ; Branton, ix. 1929. **SOMERSET** : Luccombe, 8. viii. 1935. **HANTS.** : Blackwater, New Forest, 30. v. 1923, 3. viii. 1919. **SURREY** : R. Mole, Leatherhead, 9. vi. 1925 ; Mickleham, 6. vi. 1930. **HEREFORD** : R. Teme, Leintwardine, 16. viii.-24. ix. 1920 ; R. Monnow, 1913. **BRECON** : Talybont-on-Usk, 31. vii.-10. x. 1931. **DERBY** : R. Dove, 4. x. 1913. **YORKS.** : R. Ribble. Gisburn, viii. 1931 ; R. Wharfe, Hebden, viii., ix. 1931. **NORTHUMBERLAND** : Chollerford, 29. viii. 1936. **WESTMORLAND & N. LANCS.** : L. Windermere, vi. 1929, 29. vii.-4. viii. 1932, 7. vi.-1. x. 1941 ; R. Crake, 30. viii. 1941 ; R. Brathay, 2. ix. 1941 ; Troutbeck, 21. ix. 1941 ; Blelham Beck, 26. ix. 1941. **CUMBERLAND** : Ullswater, viii. 1929, 27. vii.-16. ix. 1931. **LANARK** : Carlisle, 18. ix. 1885. **PERTH** : L. Awe, viii. 1922 ; L. Tay, ix. 1923. **ARGYLL** : Glen Lonan, 25. viii. 1929. **ARRAN** : Slidery, viii.-ix. 1926. **GALWAY** : 3-9. viii. 1926.

I have seen very little material of this species from the Continent, the only examples in the British Museum collections being from the Pyrenees.

As *E. longicauda*, this species has been generally supposed to be a late summer and autumn insect, whereas on Windermere the main hatch of *dispar* is in June. The flight periods, however, overlap, as I have seen examples of *longicauda* from several streams in June, and there is a secondary hatch of *dispar* on Windermere in September, although the species occurs sporadically throughout the season from early June to the beginning of October. This secondary hatch, which was smaller both in numbers and in size of individuals, suggests that the species may be two-brooded, as in the form of *E. venosus* studied by Miss Rawlinson on the R. Alyn. Early summer examples of *dispar* from streams are not common in the material at my disposal, and it may be that in streams there is only a partial spring brood, the main hatch being in the autumn, the reverse of what appears to be the position in Windermere. Such early specimens from streams that I have seen are larger than the autumn ones, as is the case with the Windermere specimens.

The suggestion has been made that the August Dun is a seasonal form of the False March Brown (*E. venosus* F.). The capture of both forms on the wing on the same day on the same stretch of the Troutbeck in September appears to me to be good evidence to the contrary.

The nymph of this species inhabits the stony shores of lakes such as Windermere and Ullswater, and also streams, usually fast and stony.

The flight of the male *dispar* is very steady, much more so than in that of *H. lateralis*, which is frequently on the wing with *dispar*. They fly head-on to any slight breeze, their fore legs extended and closely pressed together, setæ divergent. The wings are in rapid and continuous

Fig. 7.

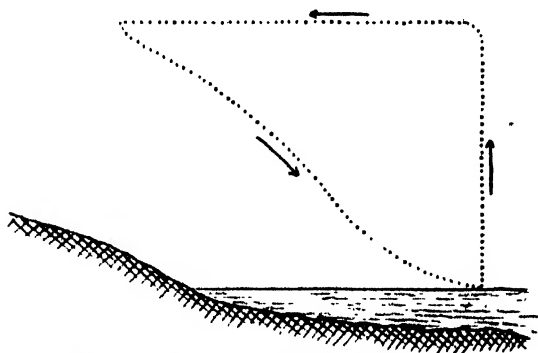


Diagram of egg-laying flight of *E. dispar*, ♀.

motion, with no pause during the descending flight. In early June numbers were on the wing over the shore of Windermere near Wray Castle between 4.30 and 5.30 P.M. G.M.T. Later in the evening, about 7.30 P.M. G.M.T., some males were seen flying much higher (10–20 ft.) around the trees. In mid-June some males were seen flying out over the lake as late as 9 P.M. G.M.T. Females were not often seen on the wing, being more frequently found hiding amongst foliage during the day-time, as also were the subimagines. A female was observed ovipositing one afternoon in September at the edge of the lake. She came gliding down from a height of about twelve feet, alighted on the surface for a moment and



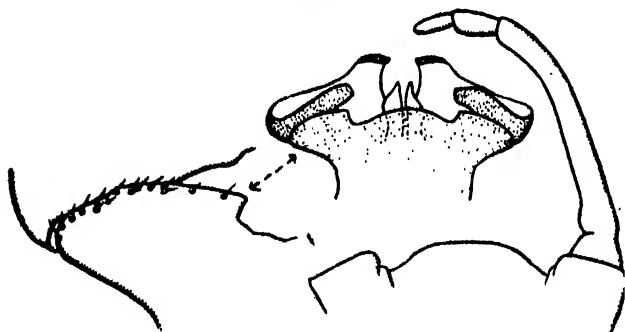
then rose vertically to about the original height, flew back over the land and repeated the glide (fig. 7). This procedure was repeated four times, after which the female flew away inland.

*Ecdyonurus insignis* (Eaton, 1870). (Fig. 8.)

1863. *Baëtis montana* Hagen (*nec* Pict.), Ent. Ann. 1863, p. 26.  
 1870. *Heptagenia insignis* Eaton, Trans. Ent. Soc. Lond. pp. 7-8.  
 1871. *Heptagenia insignis* Eaton, *op. cit.* p. 153, pl. 6, figs. 26, 26a, b.  
 1887. *Ecdyurus insignis* Eaton, Trans. Linn. Soc., Zool. (2) iii. pp. 288-9, pl. 24, fig. 46 d.  
 1909. *Ecdyurus insignis* Klapálek, Süßwasserf. Deutschl. viii. p. 26, figs. 38-39.  
 1910. *Ecdyurus rhenanus* Neeracher, Rev. suisse de Zool. xviii. p. 566, fig. 8.  
 1929. *Ecdyonurus insignis* Ulmer, Tierw. Mitteleur. iv. pp. 30-31, figs. 112-113.  
 1930. *Ecdyonurus insignis* Schoenemund, Tierw. Deutschl. xix. pp. 22-23, 140-141.

♂ (dried).—Notum of thorax medium fuscous. Abdomen pale cream or ivory-white, rather translucent, segments 9-10 yellowish-brown. Segments 2-8 each with a piceous stripe on the side, starting at the spiracle, extending obliquely backward to the apical margin, becoming somewhat dilated, and continuing over the dorsum as a narrow apical band to meet the opposite stripe. Sternites ivory-

Fig. 8.



*E. insignis*, male. Forceps-base and right clasper, ventral; penis lobes, dorsal, more enlarged: outer portion of basal sclerite, further enlarged.

white, each with a median basal spot, a pair of divergent lines and pair of small dots piceous. Forceps fuscous, forceps-base convex at its apical margin, not toothed.

Penis-lobes outspread, sub-triangular, outer sclerites rounded at apex. Inner apical sclerites slightly incurved, with acute apices. The out-turned portion of the basal sclerite moderately broad, its apex bearing a number of short setæ. Caudal setæ fuscous, paler apically. Fore leg fuscous, middle and hind legs yellowish-brown. Wings vitreous, colourless, costal and subcostal areas very faintly suffused with yellowish, pterostigma pale fuscous, slightly darker at its proximal end. Venation reddish-fuscous, cross-veins in costal, subcostal and radial areas narrowly bordered with dark fuscous or piceous. Base of anal veins in fore wing colourless.

♀ (dried).—Very similar in appearance to the male.

*Subimago* (dried).—Membrane of the wings pale greyish, venation fuscous, cross-veins bordered with fuscous, showing clearly against the background. Costal and subcostal cross-veins more heavily marked as in imago. Abdomen pale fuscous with piceous markings as in imago.

*Nymph*.—I have not met with the nymph of this species, which is apparently not found within the limits of the Lake District. According to Schoenemund, it is easily distinguished by the presence of abdominal branchiæ under each of the seven pairs of lamellæ. The other species have them under the first six pairs only.

Length of anterior wing : ♂ 10, ♀ 11–12 mm.

Length of seta : ♂ 30, ♀ 22 mm.

*Distribution*.—Eaton records the species from the rivers Dart, Kennet and Eden. I have seen examples from the following localities:—DEVON: Newton Abbot, 20. vi. 1922. DORSET: Charmouth, vii. 1924. BERKS.: Reading, vi. 1868. BRECON: Talybont-on-Usk, 30. vi.–21. vii. 1922. YORKS.: R. Diphle, Gisburn, 11. vii. 1933; Bainbridge, 28. vi. 1936. CUMBERLAND: R. Eden, Salkeld, vi.–viii. 1885. It is fairly widespread on the Continent.

The nymph apparently prefers rather large, fast streams and rivers.

Species doubtfully or incorrectly placed on the British list.

*Ecdyonurus forcipula* (Pictet, 1844). (Figs. 9, 10.)

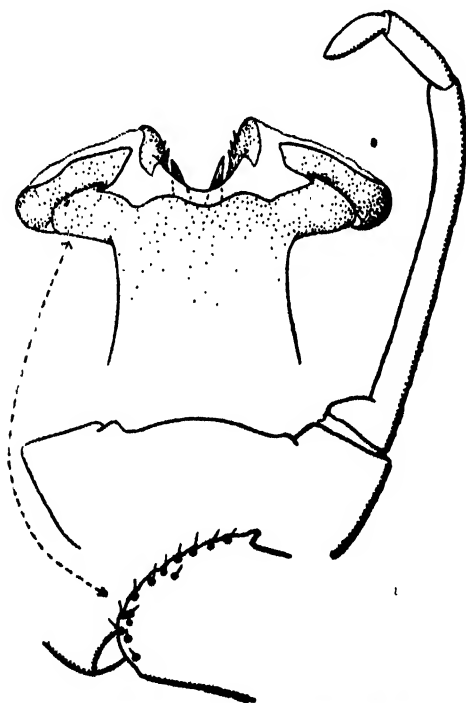
1844. *Baëtis forcipula* Pictet (Kollar MSS.), Hist. Nat. Névr. ii. Ephém. pp. 169–170.

1871. *Heptagenia venosa* var. *forcipula* Eaton, Trans. Ent. Soc. Lond. p. 152.

1887. *Eodyurus forcipula* Eaton, Trans. Linn. Soc., Zool. (2) iii. pp. 286-7 (partim, Apennino Pistoiese).  
 1909. *Eodyurus forcipula* Klapálek, Süßwasserf. Deutschl. viii. p. 28,  
 1920. *Eodyonurus forcipula* Ulmer, Tierw. Mitteleur. iv. p. 32. fig. 120.  
 1930. *Eodyonurus forcipula* Schoenemund, Tierw. Deutschl. xix. pp. 23-24, 84, figs. 28, 142.  
 1935. *Eodyonurus forcipula* Hincks & Dibb, J. Soc. Brit. Ent. i. pp. 75-76.

The first account of this species is in the form of a note appended to the description of *Baëtis venosa* F. by Pictet,

Fig. 9.



*E. forcipula*, male (Italian example). Forceps-base and right clasper, ventral; penis lobes, dorsal, more enlarged; outer portion of basal sclerite, further enlarged.

1844, in which he suggests that there is probably a new species confused with *venosa* in collections. He gives some characters whereby it may be distinguished, but

does not figure it nor describe it fully, as he had no material preserved in alcohol, and he believed that the description of dried material was open to grave risk of error. He concludes by, pointing out that should it subsequently prove to be a new species it should bear the name *forcipula*, under which name he had received specimens from M. Kollar. Eaton (1871) refers to it as a variety of *venosa*, saying (incorrectly) that it was undescribed. In 1887 he gave a full description of *forcipula* with lists of localities. Many of his specimens are in the McLachlan collection, and a large proportion of them prove to be *Ecdyonurus helveticus* (Etn.). The remainder, from the Apennino Pistoiese, agree well with his description, and I am accepting them as Eaton's concept of *forcipula* Pictet. I have also found further material of *forcipula* confused with *venosus* in the McLachlan collection from various continental localities.

*E. forcipula* has been provisionally placed on the British list on the strength of the discovery of nymphs in various localities answering to the description of *forcipula* nymphs given by Schoenemund. I have not seen any nymphs as yet which I could unhesitatingly say were *forcipula*, nor have I met with any adults of this species from Britain. The species is certainly closely allied to *E. torrentis*, and it is quite conceivable that white-spotted examples of this species might be mistaken for nymphs of *forcipula*. I have seen such white-spotted nymphs of *torrentis*, but in none was the extent of the white as great as in Schoenemund's figure. These white markings are by no means restricted to *forcipula* and *torrentis*, as I have noticed nymphs of *E. dispar* from Windermere with two white spots, one on the head and one on the thorax.

General appearance of adult much as in *torrentis*. The abdomen is more yellowish-brown, and the lateral markings are triangles rather than stripes. Pleuræ and sternites are pale yellowish-brown. Forceps and genitalia much as in *torrentis*, the outer portion of the basal sclerite of the penis broader and with more numerous bristles. Proportions of anterior male tarsus as in *torrentis*. Middle and hind legs yellowish-brown, hind femora usually without any dark streak at apex of outer surface. Wings much as in *torrentis*, costal and subcostal areas sometimes lightly shaded with yellowish.

Distribution on the Continent : Germany, Switzerland, France, Italy, according to material which I have been able to examine.

*Ecdyonurus fluminum* (Pictet), 1844. (Fig. 10.)

1844. *Baëtis fluminum* Pictet, Hist. Nat. Névr. ii., Ephém. pp. 164-169, pls. xvi.-xix.

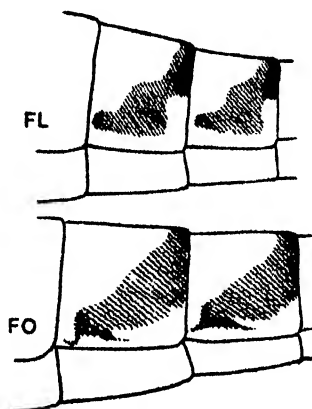
1845. *Baëtis fluminum* Imhoff & Labram, Ins. d. Schw. iv. (an unnumbered plate and descriptive matter).

1871. *Heptagenia fluminum* Eaton, Trans. Ent. Soc. Lond. p. 146.

1887. *Ecdyurus fluminum* Eaton, Trans. Linn. Soc., Zool. (2) iii. pp. 289-291, pl. lxi. (partim, examples from Genthod and Evian).

This species was placed in the synonymy of *E. longicauda* (Steph.) by Blair (1929) on the recommendation of Dr. G. Ulmer. I have not been able to examine Pictet's types (which according to a MS. note by Eaton are

Fig. 10.



*E. fluminum* and *forcipula*, males. Pattern of 6th and 7th abdominal segments (Swiss examples).

subimagines), but study of McLachlan's collection raises doubts whether Ulmer was correct in sinking *fluminum* as a synonym of *longicauda*. Eaton, when dealing with *fluminum* in his Revisional Monograph, mentions a dark and a light variety of the species. Both these forms are present in McLachlan's collection, and I consider the light

variety to be a distinct species. There is an error in Eaton's description of the adult. The piceous or black stripe extending from the tegulæ to the fore coxæ is present in the light form and not in the dark form, as stated by Eaton. There are no examples in the McLachlan collection from the actual type-locality, but specimens from Genthod, Lake Leman, and two females from Evian agree very well with the original description. Examples from Basle and Aix-les-Bains appear to belong to yet a third species.

*E. fluminum* appears to be very like *E. forcipula*, the male penis-lobes being almost identical. The forceps-base is perhaps less strongly toothed, and there seems to be some difference in the pattern of the abdominal tergites, but I have not sufficient material of *fluminum* to discover whether this is constant (fig. 10). The pterostigma is rarely shaded with brown, and *C. Sc.* and *R* are pale yellowish-brown, not dark brown.

*Baëtis fluminum* Brauer (1871, *Neur. Austr.* p. 26) cannot be this species, or even this genus, if the description is correct. Brauer declaring that the first and second tarsal segments of the fore leg were of equal length.

*Ecdyurus fluminum* Klapálek (1909, *Süsswasserrf. Deutschl.* viii. p. 28) may be conspecific with *fluminum* Pict., but in his figure the penis-lobes appear too thin (more as in the examples from Basle and Aix-les-Bains). *Ecdyonurus fluminum* Ulmer (1929) has very definite teeth on the forceps-base, but his figure 118 *b* agrees very well as regards pattern. Fig. 118 *a* shows a pattern more like Eaton's pale variety, and I suspect that he has confused more than one species, especially as British examples of *dispar* sent to him by Dr. Blair were returned as *fluminum*. Schoenemund (1930) also appears to have confused two species, as his figure of the anal appendage recalls those of *dispar* and the abdominal marking is of the pattern found in the pale variety, though from his description it is a darker brown insect.

XLI.—*New Species of Chrysomelidæ (Coleoptera) from the Fiji Islands.* By G. E. BRYANT, F.R.E.S., Entomological Assistant, Imperial Institute of Entomology.

THE types of the following new species have been presented to the British Museum :—

CRYPTOCEPHALINÆ.

*Pycnophthalma cuprea*, sp. n.

Ovate, above entirely coppery, clothed with very short close grey pubescence, finely punctured, the antennæ and legs flavous, the four apical segments of the antennæ tinged with fuscous.

Length 2 mm.

Head deeply embedded in the prothorax, the eyes very large, meeting at the base, strongly notched. Antennæ short, extending to the base of the prothorax, flavous, the four apical segments tinged with fuscous, the first segment the longest, thickened and slightly club-shaped, the second short, half as long as the first, the third to the fifth slender and about equal to each other, the remainder about equal and slightly thickened. Prothorax coppery, clothed with fine short pubescence, very finely punctured, transverse, widest at the base, the sides slightly rounded and contracted in front, the sides with an impressed oblique line in front of the middle, the basal margin with a lobe opposite the scutellum. Scutellum very small, oblong, the apex rounded, impunctate. Elytra coppery, clothed with very short fine grey pubescence, very finely punctate-striate, the interstices between the striæ very finely punctured; at the base, inside the shoulder, there are three short longitudinal impressions. Legs entirely flavous. Underside black, the first ventral segment very long, as long as the three following, impunctate. Female with the apical segment deeply notched.

Fiji Is.: Mount Penang, 20. x. 1929 (*W. Greenwood*), 2 specimens.

Allied to *P. ænea*, Bry., from the New Hebrides, but differs in colour, and the prothorax with one impression at the side.

*Pycnophthalma leveri*, sp. n.

Upper side bronze, underside black, prothorax clothed with fine pubescence, elytra with small greyish scales, antennæ with the five basal segments flavous, and the six terminal tinged with fuscous.

Length 2 mm.

Head deeply embedded in the prothorax, impunctate, the eyes very large, touching each other on the upper side of the head, strongly notched opposite the insertion of the antennæ. Antennæ extending a short way beyond the base of the elytra, the five basal segments flavous, the six terminal tinged with fuscous, the first segment the longest, nearly twice as long as the second, the third to the fifth more slender, each longer than the second and about equal to each other, the terminal segments slightly thickened. Prothorax bronze, with very fine punctures and fine scattered pubescence, transverse, the sides compressed near the middle, and the front margin deeply impressed, widest at the base and contracted in front, the sides feebly margined, the basal margin produced with a lobe opposite the scutellum, which is oblong and very small. Elytra bronze, clothed with very small greyish scales, very finely punctate-striate, the three striæ near the side margin deeper. Legs with the femora black, the tibiæ and the tarsi flavous. Underside black, with fine pubescence, the first ventral segment the longest, about equal to the second and third together, the female with the last ventral segment deeply notched.

FLJI Is.: Nadarivatu, 25. vi. 1941 (*R. A. Lever*), 4 specimens.

Allied to *P. tutuilana* Mlk., from Samoa, differs in colour, and in being pubescent on the prothorax, and the elytra with scales and the intervals between the striæ not raised.

*EUMOLPINÆ.**Trichostola vitiensis*, sp. n.

Oblong, above deep bronze, underside black, head and prothorax strongly punctured, elytra punctate-striate, clothed with grey pubescence, the three basal segments of the antennæ, labrum and legs fulvous.

Length 2 mm.



Male and female.—Head deep bronze, closely punctured, clothed with fine pubescence, the labrum fulvous. Antennæ long and slender, extending well beyond the middle of the elytra, female slightly shorter, the three basal segments fulvous, the remainder black, the two basal segments more dilated, the third to the sixth slender and about equal, the seventh to the eleventh thickened and about equal, the apical segment acuminate. Prothorax deep bronze, slightly transverse, strongly punctured, clothed with fine scattered pubescence, the sides rounded, very slightly contracted in front, the anterior margin narrowly fulvous. Scutellum deep bronze, subquadrate, impunctate. Elytra deep bronze, sides parallel and rounded at the apex, the base broader than the base of the prothorax, strongly punctate-striate, clothed with very fine pubescence. Legs fulvous, the apex of the tibiæ and tarsi tinged with fuscous. Underside black, meso- and metasternum strongly punctured, the first ventral segment of the abdomen the longest, the second to the fourth each shorter and about equal, impunctate.

FIJI Is.: Nadarivatu, 25. vi. 1941 (*R. A. Lever*), 4 specimens; FIJI Is.: Nausori, v. 1921 (*R. Veitch*), 1 specimen.

Allied to *T. puncticollis* Jac., but differs slightly in the stronger puncturation, and in the elytra being punctate-striate, and the colour deep bronze with green reflections.

*Trichostola evansi*, sp. n.

Below black, above metallic with a purple tinge, clothed with fine grey pubescence, the six basal segments of the antennæ flavous, the head finely, prothorax and elytra strongly punctured, legs with the tibiæ and tarsi fulvous.

Length 2.5 mm.

Head metallic with purple tinge, very finely punctured, labrum fulvous, a transverse impression between the eyes. Antennæ slender, extending almost to the middle of the elytra, the six basal segments flavous, the five terminal fuscous, the two basal segments more dilated, the third to the sixth slender and about equal, the apical segment the longest and acuminate. Prothorax metallic with a purple tinge, transverse, the sides rounded and contracted in front, strongly and evenly punctured, clothed with fine

pubescence. Scutellum black, impunctate. Elytra very little broader than the base of the prothorax, the sides parallel and rounded at the apex, metallic, purple, strongly and evenly punctured, clothed with fine grey pubescence, a slight depression below the shoulders. Legs with the femora fuscous, the tibiæ and tarsi fulvous. Underside black.

FIJI Is : Taveuni, near Bucalevu, 28. iii. 1924, 500–600 ft. (*Dr. H. S. Evans*), 3 specimens.

Allied to *T. leveri* Bry., but differs in its larger size, colour, and much coarser puncturation.

*Trichostola leveri*, sp. n.

Below black, above cupreous, pubescent, antennæ with the six basal segments of the legs flavous, the head, prothorax and elytra strongly punctured.

Length 2 mm.

Head cupreous, strongly punctured and pubescent, the labrum flavous. Antennæ long and slender, extending to the middle of the elytra, the six basal segments flavous, the remainder tinged with fuscous, the two basal segments more dilated, the third to the sixth slender and about equal to each other, the five terminal segments slightly thickened. Prothorax cupreous, strongly punctured and clothed with fine pubescence, strongly transverse, the sides rounded and contracted in front. Scutellum cupreous, impunctate, subquadrate. Elytra cupreous, strongly punctured, the punctures irregular, clothed with grey pubescence, very little wider at the base than at the base of the prothorax, the sides parallel and rounded at the apex. Legs entirely flavous, clothed with fine short golden pubescence, the male with the basal segment of the front tarsus dilated. Underside black, the meso- and metasternum strongly punctured, the ventral segments of the abdomen almost impunctate, the first segment the longest, the remainder about equal to each other.

FIJI Is. : Nadarivatu, 25. vi. 1941 (*R. A. Lever*), 2 specimens ; FIJI Is. : Taveuni, near Bucalevu, 500–600 ft., 28. iii. 1924 (*Dr. H. S. Evans*), 2 specimens.

Allied to *T. puberula* Boh., but much smaller, and the base of the prothorax more transverse, and the puncturation of the elytra more confused.

*Nodostoma vitiensis*, sp. n.

Entirely fulvous, except the five terminal segments of the antennæ which have the apical half fuscous, the elytra entirely fulvous or with a varying degree of black, not extending to the shoulders or the apex.

Length, 3 mm.

Male and female.—Head fulvous, nitid, impunctate. Antennæ longer in the male, extending slightly beyond the middle of the elytra, fulvous, the five apical segments with the apical half fuscous, the first segment longer and more dilated than the second, the second to the sixth slender, about equal to each other, the seventh to the eleventh about equal to each other, slightly thickened, the apical segment acuminate. Prothorax fulvous, nitid, slightly transverse, the sides rounded, slightly more contracted in front than behind, a few irregular scattered punctures. Scutellum fulvous, impunctate, triangular. Elytra broader at the base than the prothorax, the sides parallel and rounded at the apex, entirely fulvous, or with the central portion black, not extending to the shoulders or the apex, the basal half strongly but irregularly punctured in irregular striæ, the apical half almost impunctate, and nitid. Legs fulvous, somewhat elongate, the intermediate and posterior tibiæ emarginate at the apex, claws appendiculate. Underside fulvous, the ventral segments of the abdomen all about equal and finely punctured.

FIJI Is. : Taveuni, 18. vi. 1924 (*Dr. H. S. Evans*), 4 specimens ; FIJI Is. : Suva, 20. ii. 1925 (*H. W. Simmonds*), 2 specimens ; FIJI Is. : Suva, 20. ii. 1938 (*R. A. Lever*), 2 specimens ; reported on cotton.

The first species of *Nodostoma* to be recorded from Fiji. It belongs to the group with the sides of the prothorax rounded and not angled. These will probably in time have to be separated from *Nodostoma*, as it is a large unwieldy genus of over 180 described species.

XLII.—*New Species of African Chrysomelidæ (Coleoptera).*

By G. E. BRYANT, F.R.E.S., Entomological Assistant,  
Imperial Institute of Entomology.

THE types of the following new species have been presented to the British Museum :—

CRYPTOCEPHALINÆ.

*Cryptocephalus taylori*, sp. n.

Pale flavous, the breast black, head with a short median longitudinal black stria at its base, prothorax with a median V-shaped black pattern, and a black stria near the side margins, finely punctured, elytra with a sutural and sublateral black stripe, the latter abbreviated at the apex, strongly punctate-striate, the interstices with a fine line of punctures.

Length 3 mm.

Male and female.—Head pale flavous, the labrum slightly darker, a short median black longitudinal stria extending from the base to the middle of the eyes, strongly but not closely punctured. Antennæ rather short, extending slightly beyond the base of the prothorax, the five basal segments flavous, the remainder black, the first segment the longest, the six terminal segments slightly thickened. Prothorax twice as broad as long, pale flavous, a median black V-shaped pattern extending from the base, but not touching the anterior margin, a black stripe on either side parallel with the side margins, strongly but not closely punctured. Scutellum black, nitid, the apex rounded. Elytra pale flavous, the suture narrowly black, a sublateral black stripe abbreviated at the apex and curving inwards, strongly punctate-striate, the interstices with a row of fine punctures. Legs flavous. Underside with the breast black, the metasternum punctured, the ventral segments of the abdomen flavous, the first segment the longest, the second to the fourth shorter and about equal, finely punctured, the female with the apical segment notched.

UGANDA: Kawanda, 21. x. 1940 (*T. H. C. Taylor*), 2 ♂♂ and 2 ♀♀. Reported feeding on the leaf of "Muki-kimbo."

Allied to *C. nigrofrontalis* Jac., from Natal, but differs in the markings on the head and prothorax, and its paler colour.

*EUMOLPINÆ.**Syagrus flavescens*, sp. n.

Entirely flavous, the antennæ long and slender, the head and prothorax finely punctured, elytra punctate-striate, the legs with the anterior femora with a strong tooth, the intermediate and posterior feebly toothed.

Length 3 mm.

Head flavous, very finely punctured, a short median longitudinal impression on the vertex. Antennæ flavous, long and slender, extending beyond the middle of the elytra, the two basal segments more dilated than the remainder. Prothorax flavous, slightly transverse, the sides slightly rounded, slightly contracted in front, the basal angles slightly produced, finely punctured, but the punctures at the sides slightly stronger. Elytra flavous, elongate, the sides widest behind the middle and rounded at the apex, punctate-striate, the punctures not close together. Legs flavous, the anterior femora with a strong tooth, the middle and posterior pairs feebly toothed. Underside flavous, the ventral segments the first the longest, the second slightly longer than the third, the third about equal to the fourth, all finely punctured.

UGANDA: Bufumbira, iv. 1939, No. 674 (T. H. C. Taylor), 5 specimens.

Allied to *S. insignitus* Jac., but differs in the elytra being less parallel-sided and broadening behind the middle, and the puncturation of the striæ different.

*HALTICINÆ.**Physonychia fulvicollis*, sp. n.

Oblong-ovate, parallel, subcylindrical, rounded at the apex. Head black, prothorax, legs and underside fulvous, elytra metallic green, very closely and finely punctured.

Length 7-8 mm.

Head short, transverse, very rugosely punctured, the basal half black, the labrum and antennal tubercles fulvous, a triangular depression behind the insertion of the antennæ, the eyes large and prominent. Antennæ long, filiform, pubescent, extending to the middle of the elytra, the seven basal segments fulvous, the remainder tinged with fuscous, the basal segment long and broad, more than twice as long as the second, somewhat flattened, the third to the sixth elongate, the fourth to the sixth

each slightly longer than the third, the seventh to the eleventh slightly thickened and fuscous. Prothorax fulvous, transverse, broadest at the base, the sides margined and contracted in front, the anterior angles depressed and prominent, rugosely and coarsely punctured. Scutellum fulvous, impunctate, subtriangular with the apex rounded. Elytra metallic green, closely and rugosely punctured, the sides with scattered golden pubescence, slightly broader than the base of the prothorax, the sides parallel and rounded at the apex, two almost obsolete longitudinal ridges extending from the shoulders to the apex, the sides narrowly margined. Legs fulvous, the male with the basal segment of the anterior tarsi dilated, the hind tarsus with the apical segment with a globular inflation.

Underside fulvous, the ventral segments all about equal and feebly punctured and pubescent.

KENYA: Kakumga Forest, 4800–5200 ft., 21. v. 1911 (*S. A. Neave*), 2 specimens; KENYA: Nyangori, N. Kairondo, 4800 ft., 18. v. 1911 (*S. A. Neave*), 1 specimen; UGANDA: Kawanda, 5. i. 40 (*T. H. C. Taylor*), 1 specimen; UGANDA: Bugomola, 24. iv. 1927 (*H. Hargreaves*), 1 specimen.

Allied to *P. viridipennis* Dalm., from W. Africa, but differs in the green elytra being less smoothly metallic the punctures finer and closer, and the basal half of the head black.

*Toxaria cœruleipennis*, sp. n.

Ovately rounded, very convex, the head, prothorax, antennæ and legs flavous, the elytra metallic blue, underside with the meso- and metasternum and abdomen black. Prothorax transverse, impunctate, the elytra finely and irregularly punctate-striate.

Length 5–6 mm.

Male and female.—Head flavous, impunctate, nitid, a short longitudinal impression behind the insertion of the antennæ not passing the base of the eyes. Antennæ flavous, extending almost to the middle of the elytra, the first segment the longest and more thickened, the second and third short and about equal to each other, the following all elongate, about equal and pubescent. Prothorax flavous, impunctate, nitid, transverse, the sides slightly rounded, more contracted in front, the anterior angles blunt, the posterior margin on each side with a small

notch. Scutellum fulvous, triangular, impunctate. Elytra metallic blue, wider at the base than the prothorax, strongly convex, finely and irregularly punctate-striate, a rather deep depression below the shoulders, the sides almost parallel and rounded at the apex. Legs flavous, clothed with very short fine golden pubescence, the posterior femora incrassate. Underside, the prosternum flavous, the meso- and metasternum shiny black, finely punctured, the ventral segments of the abdomen black, finely and shallowly punctured, the apical segment tinged with fulvous.

UGANDA : Kawanda, 24. x. 1940 (*T. H. C. Taylor*), 3 specimens ; UGANDA : Kampala, 6. x. 1915, 1 specimen ; UGANDA : Mesaka Rd., 6. iv. 1931 (*G. H. E. Hopkins*), 1 specimen ; KENYA : Kalinzu, ix. 1932 (*T. Jackson*), 4 specimens ; KENYA : Kaimosi, iv. 1932 (*A. Turner*), 1 specimen.

Allied to *Toxaria indica* F., and *T. impressipennis* Jac., (sub. *Podagricæ*), but differs in its blue colour and the antennæ being entirely flavous, and by its slightly larger size.

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**XLIII.—The Skull-characters of some of the Forms of Sambar (*Rusa*) occurring to the East of the Bay of Bengal.—Part I.**  
By R. I. Pocock, F.R.S. (Zoological Department, Natural History Museum).

THE Deer of the genus *Rusa*, trivially known as Sambar, are widely distributed in the Oriental Region, ranging from Ceylon and India in the west to the Philippines, Mariannes, Moluccas and elsewhere in the east. They carry a host of scientific names ; but the data are at present inadequate to determine how many of them represent distinguishable forms, and probably no two authors will agree as to the numbers of species and subspecies that are admissible, the question being complicated by the known custom of the Malays of transporting useful mammals from one island to another. One fact is, however, quite obvious, namely their diminution in size when traced from west to east, the Indian form, which may stand at least 5 feet at the shoulder, being the largest and some of

the Philippine forms, about 2 feet at the shoulder, the smallest.

In this paper, and others to follow, an attempt has been made to define some of the distinguishable forms by their skull characters\* which were hardly touched by Lydekker in Vol. IV. of his Catalogue in 1915; but I have been compelled to restrict my observations mainly to the material contained in the British Museum.

In his Catalogue above-quoted Lydekker regarded most of the forms he dealt with as subspecies of the typical Sambar, *Rusa unicolor*, which was originally described from Ceylon. I agree with him to a great extent on this point, but am doubtful about the status of some of the smaller forms found in the far east. One of the distinguishing features of *Rusa unicolor* is the very large and deep gland-pit, which carries a protrusible gland, in the ♂; in the ♀ it is noticeably smaller.

*Rusa unicolor equina* Cuvier.

*Cervus equinus*, Cuvier, Oss. Foss. ed. 2, iv. p. 45, 1823, and of subsequent authors, including Lydekker, Cat. Ung. Brit. Mus. iv. p. 78, 1915, where synonymy and bibliography may be found, under *Cervus unicolor equinus*.

*Rusa dejeani*, Pousargues, Bull. Mus. Paris, 1896, ii. No. 1, p. 12, 1896.

*Rusa unicolor dejeani*, G. M. Allen, Mamm. China and Mongolia, ii. p. 1169, 1940.

Locality of the type of *equinus*, Sumatra; of *dejeani*, Szechwan.

*Distribution*.—Sumatra and South-eastern Continental Asia from Burma to S. China and Cambodia.

A larger Sambar distinguished from the Indian race of *Rusa unicolor*, found to the west of the Bay of Bengal, by the antlers being much shorter on the average in full-grown stags and stabilised in type, the front-outer tine of the terminal fork being a sub-erect continuation of the beam, and larger than the hind-inner tine which is inclined backwards and inwards. This form of antler, found in all the rusine deer of far eastern Asia, as well as in the Axis and Hog-deer, is primitive. It occurs in the Indian race; but in this form the antlers are on the average considerably longer and unstable, the two terminal tines being

\* The external features, apart from the antlers, must be neglected until the War is over, when the skins will come back from the country whither they have been sent for safety from air-raids.



very commonly subequal, or the hind-inner may exceed the front-outer tibia in length and have an equal claim to be a continuation of the beam.

I have seen no example of the so-called southern Chinese race *dejeani*, described by Pousargues; but it was recently re-described from Watien in Yunnan by Allen, who gave a few skull-measurements.

The reason for including *dejeani* in the synonymy of *equina* is that in Allen's adult ♂ skull the length from the occipital crest to the anterior tip of the nasals was 340 mm. Since in 16 adult ♂ skulls of *Rusa unicolor* from India, Borneo and Formosa the average of that dimension is 44 mm. less than the condylobasal length, it may be inferred that the condylobasal length in Allen's skull was approximately 384 mm. Moreover, Lyon (Proc. U.S. Nat. Mus. xxxi. p. 585, 1906), gave the basal length of three ♂ skulls of *equina* from Tenasserim as 345, 353 and 370 mm. respectively; and the average superiority of the condylobasal over the basal length in skulls of *Rusa* from Continental Asia is about 25 mm. Hence the basal length of Allen's skull may be estimated at approximately 359 mm., only a few mm. more than the average of Lyon's three skulls.

*Rusa unicolor swinhoii* Selater. (Fig. 1.)

(The Formosan Sambar.)

*Cervus swinhoii*, Selater, Proc. Zool Soc. 1862, p. 152; *id.* Tr. Zool. Soc. viii. p. 331, 1871; and of subsequent authors, often quoted as *swinhoii*, including Lydekker, Cat. Ung. Brit. Mus. iv. p. 81, 1915, who cites it as *Cervus unicolor swinhoii* with full or tolerably full bibliographical references.

Locality of the type: Formosa.

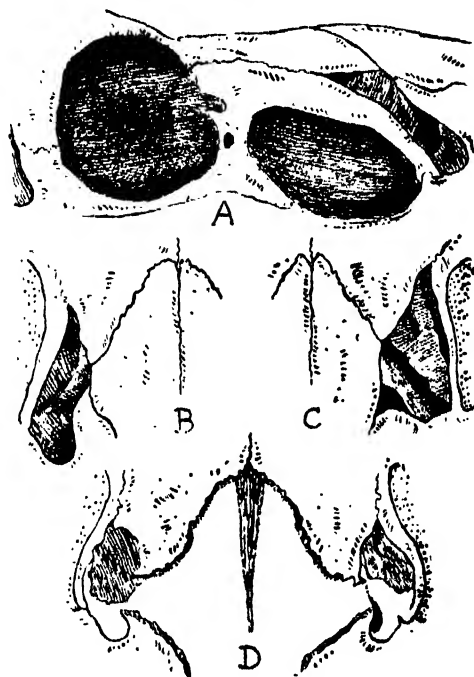
*Distribution*.—Formosa.

Distinguished from the mainland form, *equina*, at least by its smaller skull, the condylobasal length in the longest known ♂ skull being about 328 mm., about 13 in., and the average length of that area in two adult ♂ skulls 315 mm., about 12 in.

Only three adult ♂ skulls are available for examination. They differ considerably in some particulars. One (No. 70.2.10.69), exported direct from Formosa by Swinhoe, has a total length of 343 mm., and is thus a good deal shorter than adult ♂ skulls of the Indian race *nigra*, in which the length is usually over 400 mm., the average in

eleven skulls being 412 mm., a difference of nearly 3 in. It is noticeably shorter even than adult ♀ skulls of that race; and its occipito-nasal length of 300 mm. is 40 mm. less than in the ♂ skull of the Chinese specimen of *equina* recorded by G. M. Allen as *dejeani*. The gland-pit has well-defined edges and is very deep and long, as in the

Fig. 1.



- A.—Orbit, vacuity and gland-pit of Formosan Sambar (*Rusa unicolor swinhoei*). Swinhoe's wild-killed specimen.
- B.—Posterior portion of nasal, vacuity and gland-pit (dotted) of the right side of the same.
- C.—The same of the left side of skull from the Zoological Society.
- D.—Posterior part of nasal space, divided by the mesethmoid, showing the cruciform shape of the bones before removal and other features of the imperfect skull from the Zoological Society.

Indian race and *equina*, its length of about 50 mm. exceeding by 4 mm. the vertical inside diameter of the orbit. The vacuity, however, is comparatively short and narrow,

45 mm. long and 9 mm. wide, owing to the encroachment over its area behind and in front respectively of the frontal and maxillary processes, which abut against the nasals. The nasals are long, 122 mm., much more than twice as long as wide at their widest point, 47 mm.; in front they form on each side a rather pronounced convex bulge opposite the vacuities, but, owing to the forward growth of the frontals and the backward growth of the maxillæ, their areas of contact with the vacuities are exceptionally reduced, being only about 6 mm. on one side and 3 mm. on the other. I have not seen such a reduction in any other skulls of *Rusa*, although, as I have recorded elsewhere, it occurs in some skulls of *Cervus affinis*. It is probably an individual peculiarity in *swinhoii* as it is in the Himalayan species.

The second adult ♂ skull (No. 76.2.4.1) belonged to a specimen received from the Zoological Society. It is considerably older but is much shorter, its total length being 312 mm., over 1 in. shorter, its condylobasal length 302 as against 328 mm. estimated for the other, its orbito-nasal length 260 and its facial length 163\*, the corresponding dimensions in the first being 300 and 189. On the other hand, it has the forehead noticeably more elevated and is a few mm. broader, the postorbital, orbital and maxillary widths in the two being as follows, those of the first skull being bracketed:—117 (113), 148 (140), 116 (110); but the premaxillary width is slightly less, 51 as against 54 mm. The upper cheek-teeth are bigger, the premolars being 48 mm. and the molars 61 mm., as against 43 and 57 respectively in the first; but they are relatively a good deal bigger.

The gland-pit is deep, with well-defined edges, but is actually and relatively shorter than in the first skull, its length being about the same as the vertical diameter of the orbit, 44 mm. The vacuity is a little shorter, 41 mm., but it is much wider, 20 mm., owing to the nasals being narrower where they abut against them. The nasals are much shorter, like the rest of the muzzle, being only 94 mm. and at their widest by the vacuities they are only 36 mm., not forming nearly such a prominent bulge, and their free

\* This dimension is taken from the anterior edge of the orbit to the anterior end of the premaxilla.

edges bordering the vacuities are of normal length, nearly 20 mm., owing to the maxillæ not encroaching backwards over the vacuity as they do in the first skull. As in the latter the nasals penetrate deeply between the frontals, forming an acute angle, but the points of the two bones are sharper.

The third Formosan skull (Swinhoe, No. 68.3.21.24), also from the Zoological Gardens, is older than the other and has the fore part of the muzzle broken away. Since the length from the bulla to the anterior end of the cheek-teeth is a trifle shorter than in the first described skull (No. 70.2.10.69), its complete length was certainly not greater than in the latter. Its postorbital, orbital and maxillary widths are very nearly the same; but it is considerably wider across the face just in front of the eyes, as the following measurements, those of the first skull being bracketed, show:—face above the hinder end of the gland-pit 75 (65); below the gland-pit 120 (111); across the outer edge of the vacuities, 90 (76). Moreover, the outer edges of the vacuities, seen from the front, are noticeably convex, not approximately straight, and the vacuities themselves are slightly shorter, 38 mm., which is much less than the vertical diameter of the orbit, 49 mm. The gland-pit is as deep and well defined, but is shorter and higher, the length being 45 mm. and the height 40 mm. The nasals are missing, but the shape of their posterior ends is clearly shown by the surrounding bones. It is very different from that of both the other skulls, but comes nearest to the first. The nasals, however, were much broader, 59 mm. at their widest, and owing to the anterior ends of the frontals and the posterior ends of the maxillæ, where they respectively touched the nasals, being considerably wider, the expansion of the nasals on each side to reach the vacuities was much more abrupt, its anterior and posterior edges being subparallel instead of converging at a very obtuse angle, as is the case in all the other skulls of *Rusa unicolor* I have seen, and the free edge bordering the vacuity was only about 10 mm. long. These nasals indeed may be described as "cruciform." They interestingly recall in shape those of the skulls examined of the races from the Marianne and Basilan Islands.

These three skulls differ from each other in shape and in the details pointed out much more than the skulls of the Indian, Burmese and Bornean races of *Rusa unicolor*, of which tolerably good series have been examined, differ from each other respectively. A point to remember is that two of them were from the Zoological Gardens, were very likely born there and reared from birth on unnatural food\*. This may have been a factor in the abbreviation of the muzzle in No. 76.2.4.1 and the modifications of the vacuities and nasals in No. 68.3.21.24. On the other hand, skulls of the common Indian Sambar received from the Zoological Society show no such variations.

The first-described skull (No. 70.2.10.69), which came direct from Formosa and has the elongated face and the shape characteristic of *Rusa unicolor*, may be taken as normal for *swinhooi*, apart possibly from the exceptional shortness of the line of contact between the nasals and the vacuities.

The antlers of *swinhooi* are short, robust and of the *equina*-type. They are missing from the first-described skull, but in the second the right one is  $19\frac{1}{2}$  in. long, with the girth above the burr  $6\frac{1}{2}$  in.; in the third they are possibly decadent with age, the two terminal tines being merely an inch or two long, the total length being only  $12\frac{1}{2}$  in.; but the girth is  $7\frac{1}{4}$  in. and the beam up to the fork is  $10\frac{1}{2}$ , about a  $\frac{1}{2}$  in. longer than in the other skull.

*Rusa unicolor brookei* Hose. (Fig. 2.)

(The Bornean Sambar.)

*Cervus brookei* Hose, Ann. & Mag. Nat. Hist. (6) xli, p. 206, 1893.

*Rusa brookei*, Lyon, Proc. U.S. Nat. Mus. xxxi, p. 584, 1906; *id. op. cit.* xxxiii, p. 550, 1907, *id. op. cit.* xl, p. 67, 1911.

*Cervus unicolor brookei*, Lydekker, Cat. Ung. iv, p. 80, 1915.

Locality of the type: Mount Dulit, Sarawak.

*Distribution.*—Borneo and apparently the neighbouring islands of Billiton, Pagi and Nias.

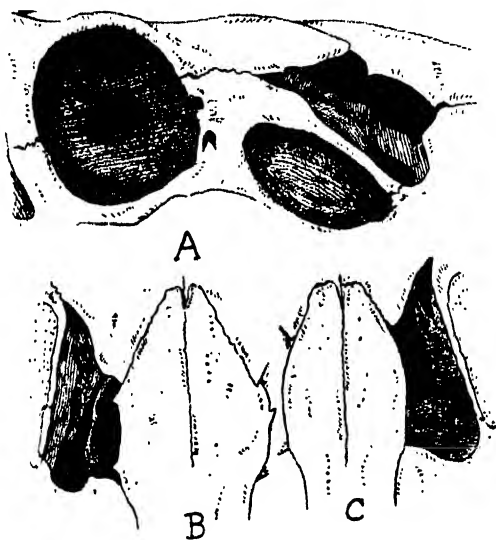
Distinguished from the Formosan race, *swinhooi*, by its rather larger skull, and from the Sumatran and Mainland

\* Referring to the remarkably concave facial profile in the skull of a Sambar from Timor, Sir Victor Brooke (Proc. Zool. Soc. 1878, p. 904) said that he had frequently seen this character in "Red Deer and Fallow Deer living under unfavourable circumstances."

race, *equina*, by its smaller skull. The average condylo-basal length in four adult ♂ skulls from Borneo is about 345 mm., 13½ in., and of six adult ♀ skulls 330 mm., 13½ in. The average of that length in the same numbers of skulls of *equina* being about 385 mm., 15½ in., in the ♂ and 350 mm., 14 in., in the ♀.

The dimensions entered above are computed from the skulls of *brookei* and *equina* in the British Museum and

Fig. 2.



A.—Orbit, vacuity and gland-pit of Bornean Sambar (*Rusa unicolor brookei*) from Baram.

B.—Posterior portion of nasals, vacuity and part of gland-pit (dotted) of the same, the expansion of the nasals asymmetrical.

C.—The same of ♀ from Sarawak, the nasals symmetrically expanded.

from the records supplied by Lyon, who was apparently the first author to establish the status of *brookei* as a smaller race than *equina*. Lyon gave the basal length of three adult ♂ skulls of *equina* from Tenasserim and one of an adult ♀ from the Malay Peninsula. I have estimated

approximately the condylobasal length of these by allowing an average excess of 25 mm. for each. The British Museum has one complete ♂ skull of *equina* from the Ruby Mines (Bruce), which has practically the same basal length, 370 mm., as Lyon's largest ♂ from Tenasserim, and five adult ♀ skulls of *equina*, three from Tenasserim (Shortridge), in which the basal length ranges from 308 to 327 mm., and two from Siam (Kloss), in which it is 324 and 334. The largest of this ♀ series is considerably shorter than Lyon's ♀ from the Malay Peninsula, which has a basal length of 350 mm.

Of skulls of the Bornean race *brookei*, Lyon had three ♂ skulls from the Sempang River and Pamukang Bay, with the condylobasal length varying from 333 to 364 mm.; and three females, one each from those localities and one from Pulo Laut, with that area ranging from 320 to 338 mm.

A ♂ skull in the British Museum from Baram (Hose, No. 1.3.13.1) is normally elongated in shape with the total and condylobasal lengths 356 mm., 14½ in., and 344, 13½ in. The gland-pit is deep with well defined edges, but is shortish, its length, 48 mm., being 1 mm. less than the vertical height of the orbit; the vacuity is 52 mm. long, 23 mm. wide, its nasal edge being 25 mm. and tolerably evenly convex; the nasals are 126 mm. long, about three times as long as wide, and have the deepish angular penetration of the frontals typical of *Rusa unicolor*.

A young adult ♂ skull from Sandakan, N. Borneo (Pryer, No. 86.1.20.9) has the condyles cut away and carries antlers presumably of the second pair, since the main beam is unbranched. Its total length is 345 mm., the length from the occipital crest to the tip of the nasals is 288 mm., and of the face 190 mm., whereas in Hose's skull from Baram those areas are 295 and 205 mm. respectively. But, although a younger skull, it is a little broader than Hose's, the postorbital and orbital widths of the two, those of Hose's skull being bracketed, being respectively 113 (110) and 144 (140). The nasals are 120 mm. long, 40 wide, and the free edge bordering the vacuity is 26 mm., being similar in shape to those of Hose's skull. The orbit also is smaller, its vertical height being only 44 mm.; the vacuity is a little longer but narrower,

55 by 21 mm., but the gland-pit is as nearly as may be the same length and height, both the vacuity and gland-pit noticeably exceeding in length the vertical height of the orbit.

According to Ward's 'Records,' 1928, the antlers of the Bornean Sambar, cited under *equina*, may just surpass 30 in. in length. Out of a very large number measured by Lyon the longest was  $22\frac{1}{2}$  in. In Hose's skull from Baram the antlers were just shed when the deer was killed. In the skull from Sandakan the antlers, judged to be the second pair, are  $14\frac{1}{2}$  in.

Three adult ♀ skulls from Sarawak (Everett) are very much alike in shape and proportions individually, and only differ from the ♂ skull in the usual sexual characters. The largest of the three (No. 79.1.27.2) has the total and condylobasal lengths 354 and 344 mm. respectively, and is about the same length as the ♂ skull from Baram. The gland-pit is at least as long and deep as in the ♂, an unusual feature, but not so high, its upper rim being thicker and its lower border not so defined; it slightly exceeds the vertical height of the orbit, which is 46 mm. The vacuity is 53 mm. long, 18 wide, narrower than in the ♂ from Baram; the nasals are very similar in shape but their free edges bordering the vacuities are a trifle more convex. The shortest of the three ♀ skulls, not appreciably younger than the longest, has the total and condylobasal lengths 324 and 314 mm. respectively, and is correspondingly narrower everywhere, its orbital width, for instance, being 114 as opposed to 128 mm.; the gland-pit is 38 mm. long, 4 mm. less than the vertical diameter of the orbit and 10 mm. shorter than in the other skull; but the vacuity is longer, 55 mm.; the nasals penetrate the frontals less deeply and are much narrower bordering the vacuities, being three-and-a-half times as long as wide instead of about three times as in the others. The third skull (No. 79.5.3.18) closely resembles the latter in all its features, although the condylobasal length is 19 mm. less.



XLIV.—*The Cichlid Fishes of Syria and Palestine.* By  
ETHELWYNN TREWAVAS, D.Sc., British Museum  
(Natural History).

THE Cichlidæ of the Old World are an essentially African group, with a few species in Ceylon and southern India and seven in Syria and Palestine. Those of Syria and Palestine comprise four endemic species, confined to the inland drainage systems, and three Nilotic species which are found in the Jordan valley and also in the streams flowing into the Mediterranean Sea. Of the endemic forms one is a *Haplochromis* showing affinity with its congeners in the Nile and in Algeria and Tunis, the other three are so distinct from African members of the family as to form an endemic genus, recognised by Regan (1922) for one of its members and here renamed *Tristramella*.

*Synopsis of the genera.*

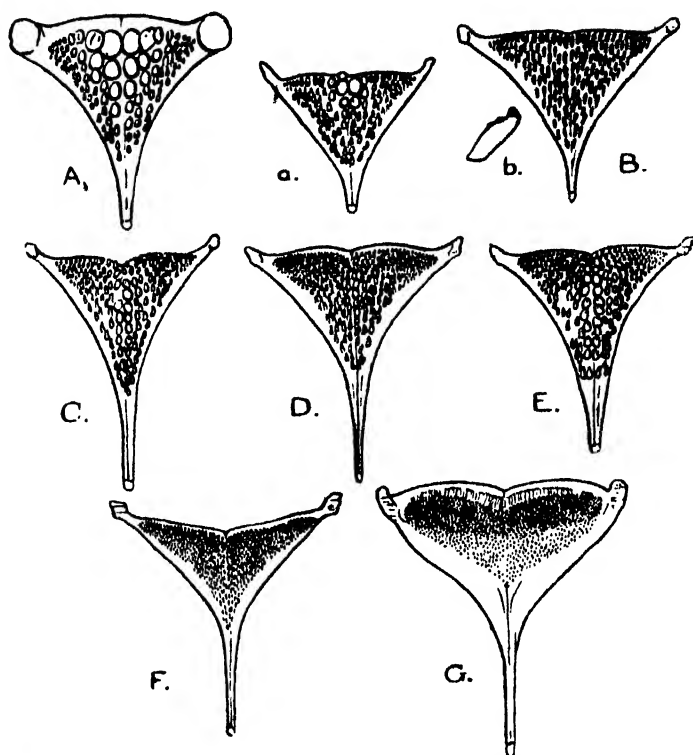
- I. Articular surface on base of skull for upper pharyngeal bones formed by parasphenoid alone.
  - Inferior apophysis for support of anterior end of air-bladder on third vertebra ..... *Tilapia*.
  - Inferior apophysis for support of anterior end of air-bladder on fourth vertebra ..... *Tristramella*.
- II. Articular surface for upper pharyngeal bones formed by parasphenoid in the middle and basioccipital at the sides; inferior apophysis on third vertebra ..... *Haplochromis*.

These are the characters used by Regan in his "Synopsis of the African and Syrian genera" (Ann. & Mag. Nat. Hist. (9) x. 1922, p. 249).

*Key for Identification of the Species.*

This key is independent of skeletal characters and is designed for practical use in the field. The pharyngeal dentition, however, is decisive. All counts and measurements are taken from Palestine specimens.

- I. Gill-rakers on lower part of anterior arch 18 to 23.
  - Lower jaw 3 to 3.2 times in the head; teeth in 3 or 4 series in upper jaw, 3 to 5 in lower; depth of preorbital bone 5 to 4.5 times in the length of head in specimens of 145 to 200 mm. standard length; caudal truncate; tooth-bearing area of



Lower pharyngeal bones of A, *Haplochromis flavio-josephi*, ♂, 68+15 mm.; a, the same, ♀, 60+13 mm.; B, *Tilapia zillii* (type of *T. andrews*), 145+38 mm.; C, *Tristramella sacra*, 145+31 mm.; D, *Tr. simonis*, 142+37 mm.; E, *Tr. magdalena*, 132+30 mm.; F, *Tilapia nilotica*, 155+43 mm.; G, *T. galilæa*, 160+40 mm.; b, a single pharyngeal tooth of *T. zillii* further enlarged. The linear magnification of A and a. is about  $3\frac{1}{4}$ , that of all the others is half as great. The teeth in *T. nilotica* and, especially, in *T. galilæa*, are more numerous than the dots representing them. The distinction between *Tr. simonis* and *Tr. magdalena* is not always so clear as in the specimens figured.

lower pharyngeal bone nearly triangular, teeth numerous but not densely crowded. Lower jaw 3.3 to 3.5 times in the length of head; teeth in 4 to 6 series in upper jaw, 5 to 7 in lower; depth of preorbital bone 4.3 to 3.5 times in the length of head in specimens of 130 to 215 mm. standard length; caudal slightly emarginate in young; dentigerous area of lower pharyn-

*Tilapia nilotica.*

- geal bone heart-shaped, bearing a dense felting of slender teeth ..... *Tilapia galima*.
- II. Gill-rakers on lower part of anterior arch 7 to 12.
- A. Head, in adult,  $\frac{1}{3}$  of standard length or less; lower jaw 2.7 to 3.2 times in the length of head; outer teeth stout, bicuspid, 34 to 50 in outer series of upper jaw in specimens of 90 to 160 mm. standard length; lower pharyngeal bone short, bearing compressed teeth, some of which are tricuspid; young with a large black spot, ringed with white, at front of soft dorsal fin. .... *Tilapia zillii*.
- B. Head more than  $\frac{1}{3}$  of standard length.
1. 9 to 12 gill-rakers on lower part of anterior arch; 58 to 80 teeth in outer series of upper jaw in specimens of 100 to 190 mm. standard length; lower pharyngeal with a middle group of enlarged, blunt teeth; 30 or 31 scales in a longitudinal series. .... (*Tristramella*).
- a. Head 2.5 times in the standard length; lower jaw 2.2 to 2.4 times in the length of head; teeth conical in adult. .... *Tristramella sacra*.
- b. Head 2.6 to nearly 3 times in the standard length; lower jaw 2.4 to 2.7 times in the length of head; outer teeth bicuspid.
- Diameter of eye contained 4.5 to 5.4 times in length of head at 125 to 140 mm. standard length; depth of preorbital 4.5 to 4.8 times ..... *Tristramella simonis*.
- Diameter of eye contained 5.6 times in length of head at 130 mm. standard length; depth of preorbital 4.3 times ..... [*magdalens.*]  
*Tristramella*
2. 7 or 8 gill-rakers on lower part of anterior arch; lower pharyngeal with a posterior group of enlarged blunt teeth; 28 or 29 scales in a longitudinal series; dark bands, often interrupted, one along the middle of the body, one along the upper lateral line, a third at base of dorsal; male with bright, ocellated spots on anal fin; no large, white-ringed spot on the dorsal fin. .... [*flavio-josephi*.]  
*Haplochromis*

*Tilapia nilotica* (Linn.).

Boulenger, Cat. Afr. Freshw. Fish. iii. p. 162, fig. 106.

For a discussion of the synonymy, limits and geographical range of this species see Trewavas, Ann. & Mag. Nat. Hist. (10) xix. 1937, p. 382.

Native name : L. Tiberias, MUSHT LUBBUD.

Depth of body contained 2.2 to 2.5 times in the length, length of head 3 or nearly 3 times. Snout 3.4 to 3.7 in length of head, 1.2 to 1.4 times diameter of eye, which is 4.4 to 4.7 in length of head. Depth of preorbital 4.6 to 5 in length of head, interorbital width 2.5 to 2.8, length of lower jaw 3 to 3.2. Cheek with 2 or 3 series of scales. Teeth small, but stouter than in *T. galilæa*, in 3 or 4 series in upper jaw, 3 to 5 in lower, outer bicuspid, inner tricuspid, 70 to 80 in outer series of upper jaw. Gill-rakers on lower part of anterior arch 18 to 22. Lower pharyngeal with dentigerous area more nearly triangular than heart-shaped, bearing numerous slender teeth which are neither so small nor so densely packed as in *T. galilæa*. Scales 31 to 33 in a longitudinal series,  $4\frac{1}{2}$  or 5 from origin of dorsal to lateral line. Dorsal XV-XVI 12-13; length of last spine contained from a little more than twice to 2.3 times in length of head. Anal III 10-11; third spine a little shorter than last dorsal. Pectoral a little longer than head. Caudal peduncle  $\frac{3}{4}$  as long as deep. Caudal truncate. Soft dorsal, anal and caudal often with dark wavy bands or series of small dark spots. Young with or without about nine transverse bars.

Described from twelve specimens, 92+28 to 195+50 mm. long, from Lakes Tiberias and Huleh. Proportions and numbers of teeth are recorded only for the four specimens of 146 to 195 mm. standard length, meristic characters for all.

Nine small specimens from Ras el Ain, near Jaffa, differ from the lake specimens in having a higher number of rays in the dorsal fin, namely, XVI 14, XVII 13 or XVII 14, average 30.1, whereas the average for the twelve lake specimens is 28.2. In these specimens also the pharyngeal teeth are fewer and coarser than in the lake forms, though both types are within the range for the species in its African habitats.

A single specimen from the Dead Sea is in rather poor condition; its pharyngeal teeth resemble those of the Jaffa specimens rather than those from Tiberias, the mouth and preorbital are rather large and the cusps have been worn off some of the outer teeth.

*Palestinian Specimens in the British Museum*  
(Natural History).

2, 176 + 46 and 195 + 50 mm...	S. of Galilee	Tristram.
	(=L. Tiberias).	
1, 102 + 30 mm. ....	" "	Craig-Bennett.
4, 92 + 28 to 104 + 30 mm. ...	" "	
4, 102 + 30 to 158 + 43 mm. ...	L. Huleh	Washbourn.
1, 123 + 34 mm. ....	"	Hornell.
9, 51 + 13 to 102 + 27 mm. ...	Ras el Ain, nr. Jaffa.	Bowsher.

*Tilapia galilæa* (Artedi).

*Sparus galilæus* Artedi, in Hasselquist, Iter Palest. p. 343 (1757).

*Chromis ? galilæus* Günther, Cat. Fish. iv. p. 273 (1862).

*Chromis tiberiadis* Lortet, Ann. Mus. Lyon, iii. 1883, p. 135, pl. vi.

*Chromis microstomus* Lortet, t. c. p. 139, pl. viii. fig. 1.

*Tilapia galilæa* Boulenger, Proc. Zool. Soc. London, 1899, p. 114.

For full synonymy, including other synonyms, based on African specimens, see Boulenger, Cat. Afr. Freshw. Fish. iii. p. 169, fig. 109 (1915).

Native name: MUSHT ABYAD.

Description based on five specimens from the Sea of Galilee, two of 207 + 50 and 215 + 55 mm. respectively and three of 113 + 30 to 130 + 35 mm., the proportions of the three smaller fish shown in square brackets.

Depth of body 2 to 2.3 [2 to 2.1] in the length, length of head 2.7 to 2.9 [3]. Length of snout 2.9 to 3 [3.2 to 3.4] in length of head, 1.6 [1.2 to 1.3] times diameter of eye. Diameter of eye 4.4 to 4.8 [4] times in length of head, depth of preorbital bone 3.5 to 3.6 [3.8 to 4.3], length of lower jaw 3.3 to 3.4 [3.5], interorbital width 2.5 [2.3 to 2.7]. Teeth very slender, in 5 to 6 rows in upper jaw, 5 to 7 in lower, outer bicuspid, inner tricuspid, 92 to 100 [64 to 82] in outer series of upper jaw. Scales of cheek in two series below eye, sometimes three in front. Preoperculum at angle often wider than scaled part of cheek. 20 to 23 gill-rakers on lower part of anterior arch. Dentigerous area of lower pharyngeal heart-shaped, with broad rounded lateral lobes, bearing a dense felting of slender, crowded teeth. 31 scales in a longitudinal series, 4½ to 5 from origin of dorsal to lateral line, 5 to 7 between bases of pectoral and pelvic fins. Dorsal XVI 13-14; spines strong, last contained 2½ [2] times in length of head. Anal III 10-11; third spine stouter and a little shorter than last dorsal. Pectoral fin 1½ to 1½ times as long as head. Caudal peduncle ¾ to ¾ times as long as deep, its length contained 2.6 to 3 times in length of head.

Caudal fin slightly emarginate in young. No dark bands on the vertical fins.

*Palestinian Specimens in the British Museum.*

4, 128+32 to 215+55 mm. . .	S. of Galilee	Tristram.
	(= L. Tiberias).	
1, 113+30 mm. . . . .	" "	Craig-Bennett.
2, 92+23 mm. . . . .	" "	" "
1, 75+20 mm. . . . .	" "	Hornell.
9, 61+14 to 91+23 mm. . .	Ras el Ain, nr. Jaffa.	Bewsher.

*T. nilotica* and *T. galilæa* occur together in many places throughout their wide range, from Senegal to the Nile and in Palestine. They are easily distinguishable by the pharyngeal dentition. In addition, *T. galilæa* has a blunter snout than *T. nilotica*, a deeper preorbital bone, a smaller mouth (measured by the length of the lower jaw) armed with more slender, more numerous teeth arranged in more series. The Ras el Ain sample and the young from L. Tiberias are without bars or series of spots on the fins, in contrast to young *T. nilotica*.

The depth of the preorbital bone and the number of teeth show parallel variations with age in the two species, as can be seen by comparing them in size-groups:—

Material.	Depth of preorbital (times in head).
<i>T. nilotica</i> , 70 to 100 mm., 8 specimens . . . . .	5 to 6·7
<i>T. galilæa</i> , 70 to 92 mm., 6 specimens . . . . .	4·7 to
<i>T. nilotica</i> , 102 to 123 mm., 5 specimens . . . . .	5 to 5·9
<i>T. galilæa</i> , 130 mm., 2 specimens . . . . .	3·8 to 4·3
<i>T. nilotica</i> , 176 to 195 mm., 2 specimens . . . . .	4·7 to 5
<i>T. galilæa</i> , 210 to 215 mm., 2 specimens . . . . .	3·5 to 3·6

The differences in numbers of teeth are shown for larger specimens in the descriptions given. In *T. nilotica* of 70 to 100 mm. standard length the teeth are in 3 series above, 3 or 4 below, 40 to 60 in the outer series of the upper jaw. Specimens of *T. galilæa* from 70 to 92 mm. have 4 or 5 series above and below, 54 to 78 in the outer series above.

*Tilapia zillii* Gervais.

For synonymy and description see Boulenger, Cat. African Freshw. Fish. iii. p. 197, fig. 126 (1915). The first specimens known from Palestine were the types of *Chromis andresæ* Günther (1864).

*T. zillii* is easily distinguished from the other species of *Tilapia* found in Palestine by the fewer gill-rakers, 8 or 9 on the lower part of the anterior arch, the deeper cheek and the almost horizontal mouth, and from all

other Cichlidæ of this region by the lower pharyngeal, which has a very short anterior blade and a broad triangular dentigerous area bearing relatively few and larger, compressed, tricuspid teeth.

The Palestine specimens in the British Museum (Natural History) number twenty, from the Sea of Galilee, from Kishon, and from two seaward flowing streams, Wadi Rubin, near Jaffa, and Wadi Selman, near Haifa. In these the scales number 29 or 30 in longitudinal series, 3 or 4 from origin of dorsal to lateral line; the dorsal fin-rays are 27 in eleven specimens, 28 in four (XV 12 in nine, XVI 11 in two, XV 13 in four). There are 9 or 10 soft anal rays.

The vertebræ, counted in two specimens, number 28 (14+14)\*.

*Specimens from Palestine in the British Museum.*

3, 94+23 to 146+40 mm. ...	S. of Galilee	Tristram.
(Types of <i>Ohromis andree</i> .)	(= <i>L. Tiberias</i> ).	
2, 115+30 and 160+42 mm.	" "	Craig-Bennett.
1, 94+23 mm. ....	" "	Hornell.
2, 110+30 and 123+30 mm.	Kishon .....	"
2, 30+8 and 40+10 mm. ....	Kishon swamps ...	Buxton.
6, 46+14 to 85+23 mm. ....	Wadi Selman, near Haifa.	"
2, 90+22 to 95+25 mm. ....	Wadi Rubin, near Jaffa.	Hornell.
1, 78+20 mm. ....	Nahr Rubin, near Jaffa.	Aharoni.
1, 122+30 mm. ....	Palestine .....	Aharoni.

**TRISTAMELLA, gen. nov.**

*Parachromis* Regan, Ann. & Mag. Nat. Hist. (9) x. 1922, p. 251 (not *Parachromis* Agassiz, 1858)†.

Type of the genus *Hemichromis sacra* Günther, 1864.

Articular surface for upper pharyngeals formed by parasphenoid alone; inferior apophyses for support of anterior end of air-bladder on fourth vertebra; lower pharyngeal bone with a middle group of enlarged teeth. Vertebræ 29 (14+15).

Jordan Valley. Three species.

The skeletal characters have been checked on one specimen of each species.

*T. sacra* and *T. simonis* inhabit Lakes Tiberias and Huleh. *T. magdalenæ* represents *T. simonis* in the waters

\* The last vertebra bearing a rib is counted as the last abdominal. The hæmapophyses of the first caudal vertebra are united below but the spine is paired.

† That this is a homonym was pointed out by Myers.

near Damascus, and perhaps should be regarded as a subspecies of the latter.

*Tristramella sacra*.

*Hemichromis sacra* Günther, Proc. Zool. Soc. London, 1864, p. 493.

*Paratilapia sacra* Boulenger, Proc. Zool. Soc. London, 1899, p. 101.

*Parachromis sacer* Regan, Ann. & Mag. Nat. Hist. (9) x. 1922, p. 251.

Native name : MUSHT KELB.

Depth of body 2.5 to 2.8 in the length, length of head (excluding projecting part of lower jaw) 2.5. Snout 2.8 to 3 times in length of head, twice to 2.3 times diameter of eye. Diameter of eye 5.6 to 6.3 times in length of head, depth of preorbital 3.9 to 4.7, interorbital width 4.1 to 4.6, length of lower jaw 2.2 to 2.4, of premaxillary pedicels 3.7 to 4.1. Lower jaw projecting. Teeth conical, in 3 or 4 series anteriorly in upper jaw, 2 series laterally, 58 to 64 in outer series. 4 or 5 series of scales on the cheek. 10 or 11 gill-rakers on lower part of anterior arch. Lower pharyngeal bone very slightly longer than wide, toothed part twice as long as anterior blade; teeth of four middle rows enlarged except posteriorly, lateral teeth slender, not densely crowded. 30 or 31 scales in a longitudinal series,  $3\frac{1}{2}$  or 4 from origin of dorsal fin to lateral line, 5 to 7 between bases of pectoral and pelvic fins. Dorsal XIV 10-11; last spine about  $\frac{1}{2}$  length of head. Anal III 8-9; third spine a little shorter than last dorsal. Pectoral  $\frac{5}{8}$  to  $\frac{9}{8}$  as long as head, extending to origin of anal or beyond. Caudal rounded, subtruncate. Caudal peduncle a little longer than deep.

Described from seven specimens, five from Lake Tiberias and two from Merom (L. Huleh), 145+32 to 190+43 mm. long. Of these, two are males with small testes, two are ripe females and three are spent females. One of the females has the mouth full of developing eggs.

*Specimens in the British Museum.*

4, 145+32 to 190+43 mm...	S. of Galilee	Tristram.
	(=L. Tiberias).	
1 skeleton .....	"	"
2, 157+35 and 175+38 mm.	Merom (=L. Huleh).	"
1, 165+40 mm. ....	L. Tiberias .....	Craig-Bennett.

*Tristramella simonis* (Günther).

*Chromis simonis* Günther, Proc. Zool. Soc. London, 1864, p. 492; Lortet, Arch. Mus. Lyon, iii. 1883, p. 143, pl. ix. fig. 1; Tristram, Faun. Palest. p. 165, pl. xvii. fig. 2 (1884).



*Chromis paterfamilias* Lortet, C. R. Ac. Sc. lxxxi. 1875, p. 1197 and La Nature, 1876, p. 81, figs.

*Tilapia simonis* Boulenger, Proc. Zool. Zoc. London, 1899, p. 125.

Native name : MUSHT MARMUR.

Depth of body 2.5 to 2.6 in the length. Length of head 2.7 to 2.8. Length of snout  $1\frac{1}{2}$  times diameter of eye, which is 4.5 to 5 in length of head. Depth of preorbital 4.5 to 4.8 in length of head, interorbital width 3.25, length of lower jaw 2.5 to 2.6, of premaxillary pedicels 4.2 to 4.3. Lower jaw slightly projecting; maxillary not extending to below eye. Teeth in 3 or 4 series, outer bicuspid, inner tricuspid, 64 to 70 in outer series of upper jaw. 3 or 4 series of scales on the cheek. 11 or 12 gill-rakers on lower part of anterior arch. Lower pharyngeal a little longer than wide, 1.7 to 1.8 times as long as the median length of its toothed area; pharyngeal teeth small, pointed and rather numerous laterally, rather stout in the middle series. Lateral line pores of preoperculum and preorbital multiple, 5 to 10 at each opening of the bony canal. 31 scales in a longitudinal series. 4 from origin of dorsal to lateral line, 7 between pectoral and pelvic fins. Dorsal XV 10; last spine 2.4 to 2.6 in length of head. Anal III 9-10; third spine a little shorter than last dorsal. Pectoral as long as head, extending to above origin of anal, or beyond. Caudal rounded, subtruncate. Caudal peduncle as long as deep or a little shorter. Colour uniform or with an opercular spot and traces of 8 dark cross-bars on the body.

\* Lake Tiberias; ? Lake Huleh.

2, 137+35 and 142+37 mm. . . . . L. Tiberias . . . . . Tristram.

1, 125+1 mm. . . . . „ . . . . . Franklin.

Five specimens of 135+32 to 180+40 mm. from Lake Huleh, and two of 125+30 mm. and 140+35 mm. from L. Tiberias, are also assigned to this species, although in the shape of the pharyngeal bone and the size of the eye they diverge from the types in the direction of *T. magdalenæ*. In the pharyngeals, however, they are nearer to the types of *T. simonis* than to *T. magdalenæ*, and the lateral line pores of the head are multiple as in *T. simonis*. The following details give the range of variation in these seven specimens :—

Depth of body 2.25 to 2.5 in the length, length of head 2.6 to 2.8. Length of snout 1.6 to twice diameter of eye, 3 to 3.5 times in length of head. Diameter of eye 5.3 to

5.7 times in length of head, depth of preorbital 4.6 to 5, interorbital width 3.25 to 3.7, length of lower jaw 2.4 to 2.7, of premaxillary pedicels 3.6 to 4. Teeth in 4 series in upper jaw, 3 or 4 in lower, 60 to 80 in outer series of upper jaw, outer bicuspid, inner tricuspid. 10 to 12 gill-rakers on lower part of anterior arch. Median length of lower pharyngeal bone a little greater than its width, 1.5 to 1.7 times that of the toothed area. 30 to 31 scales in longitudinal series,  $3\frac{1}{2}$  to 4 from origin of dorsal to lateral line, 5 or 6 between pectoral and pelvic fins. Dorsal XIV-XV 10-12; length of last spine contained 2.4 to 2.9 times in length of head. Anal III 8-10; 3rd spine shorter than last dorsal. Pectoral as long as head or a little shorter.

*Tristramella magdalenæ* (Lortet).

*Chromis magdalenæ* Lortet, Arch. Mus. Lyon, iii. 1883, p. 146, pl. ix. fig. 2.

*Tilapia magdalenæ* Boulenger, Proc. Zool. Zoc. 1899, p. 120.

Depth of body 2.3 to 2.4 in the length, length of head 2.6 to nearly 3. Length of snout 3.3 to 3.6 in length of head, 1.4 to 1.75 times diameter of eye, which is contained 4.9 to 5.7 times in length of head. Depth of preorbital 4.3 to nearly 5 times in length of head, interorbital width 3.3, length of lower jaw 2.6, of premaxillary pedicels 3.5 to 3.9. Maxillary not, or just, reaching vertical from anterior edge of eye. Teeth in 3 or 4 series, outer bicuspid, inner tricuspid, 60 to 62 in outer series of upper jaw. 4 series of scales on the cheek. 9 or 10 gill-rakers on lower part of anterior arch. Lateral line pores of preoperculum and preorbital single, or at most two or three at one opening of a bony canal. Lower pharyngeal bone a little wider than long, the length of its toothed area contained 1.5 or 1.6 times in its total length; lower pharyngeal teeth slender and crowded laterally, enlarged in 4 to 6 middle series, except posteriorly, some blunt. 30 or 31 scales in a longitudinal series, 4 from origin of dorsal fin to lateral line, 7 or 8 between bases of pectoral and pelvic fins. Dorsal XIV-XV 10-11; last spine 2.6 to 3 times in length of head. Anal III 8-9; third spine shorter than last dorsal. Pectoral a little shorter than head, extending to above origin of anal, or nearly. Caudal rounded, sub-truncate. Caudal peduncle as long as deep or a little shorter.

Near Damascus.

*Specimens in the British Museum.*

2, 106+25 mm. (syntypes) ..	Damascus .....	Lortet.
2, 76+20 and 130+30 mm. (syntypes) .....	Baret-el-Atribah, nr. Damascus.	Lortet.

The smallest specimen has been used only for characters which do not change with growth. These characters include in this case the proportions of the pharyngeal bone.

*Haplochromis flavii-josephi* (Lortet).

*Chromis flavii-josephi* Lortet, Arch. Mus. Lyon, iii. 1883, p. 141, pl. viii. fig. 2.

*Tilapia flavii-josephi* Boulenger, Proc. Zool. Soc. 1899, p. 135.

*Haplochromis flavii-josephi* Regan, Ann. & Mag. Nat. Hist. (9) x. 1922, p. 262.

Native name : KHANOUS, ADDADI.

Depth of body 2.7 to 2.9 in the length, length of head 2.6 to 2.7. Snout from as long as diameter of eye to 1.3 times as long, 3 to 4 times in length of head. Diameter of eye 4 to 4.2 times in length of head, depth of preorbital 5.3 to 5.6, interorbital width 4.2 to 5, length of lower jaw 2.5 to 2.7. Maxillary extending to vertical from anterior edge of eye or beyond. Teeth in 3 series, outer unequally bicuspid or (large male) conical, inner unequally tricuspid or conical; 38 to 44 in outer series of upper jaw. 7 gill-rakers on lower part of anterior arch (excluding that at angle of cerato- and epibranchial). 3 or 4 series of scales on the cheek. Lower pharyngeal bone larger in male than in female. with a posterior group of enlarged blunt teeth. 28 or 29 scales in longitudinal series, 5 or 6 from origin of dorsal to lateral line, 4 to 6 between pectoral and pelvic fins. Dorsal XIV 9-10. Anal III 8-9. Caudal subtruncate. Caudal peduncle a little longer than deep. Traces of three dark bands, one along middle of body, one along upper lateral line and one at base of dorsal fin. In male 1 to 3 bright ocellated spots on anal fin.

The types are males with large testes; of the other specimens one is male, one a female with ripening ovaries, and in the third the gonads are small. Proportions and tooth-counts are taken from the types and the female of 60 mm.

*Specimens in the British Museum.*

2, 49+11 and 68+15 mm. (types).	Ain-el-Tabigah.....	Lortet.
3, 41+10 to 60+13 mm.	L. Tiberias.....	Craig-Bennett.

# THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

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XLV.—*Some new and little-known Upper Cretaceous Fishes from Mount Lebanon.* By SIR ARTHUR SMITH WOODWARD, F.R.S.

[Plates III.-VII.]

IN 1893, while spending a vacation in Palestine and Syria, I visited Hakel, the well-known locality in the Lebanon, whence so many well-preserved Cretaceous fishes have been obtained. A local resident told me that similar fossil fishes were equally abundant at another village, Hajula, about six miles distant over the mountains. Circumstances prevented my going to investigate, but I sent a competent messenger who confirmed the occurrence and brought back a fine specimen of *Prionolepis cataphractus*, which I gave to the British Museum (6, pt. iv. p. 232). On returning to Beirut I reported the discovery to Prof. Alfred Ely Day, who afterwards obtained more specimens from Hajula for the American University of Beirut, and in 1901 made for the American Museum of Natural History, New York, a large collection, which was studied and described by Dr. O. P. Hay (3). In 1926 I was favoured by President Bayard Dodge and Prof. Day with the opportunity of studying the fine series of Cretaceous fishes from the Lebanon in the American University of Beirut. While there my wife and I spent a week in camp with Prof. Day, at Hajula, and we collected about

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2000 good specimens to be added to the series in Beirut, and to be used in exchange with the American and British Museums. The result was the discovery of several new genera and species, some of which it is now proposed to describe and discuss. They are illustrated in the accompanying Plates III.-VII., and in the text-figures 1-4, for which I am indebted to Miss O. F. Tassart.

An account of the prolific localities of Hakel and Sahel Alma was given by Prof. E. R. Lewis in 1878 (4). Hajula is shown in the accompanying Pl. III., by photographs taken by Prof. Day. It is situated about 3000 feet above sea-level at the end of a deep valley (fig. 1), and the fissile limestone containing fossil fishes and crustaceans crops out in the steep slope. The fossils are easily collected from the exposures (fig. 2), and the only obstacle is the terracing of the hillside by the villagers to make space for the growing of scanty crops. The fossiliferous deposits seemed to us to be of great thickness, but we did not observe any definite succession of the genera and species which are represented.

### ACANTHOPTERYGIANS.

Most of the Cretaceous Acanthopterygians hitherto studied and described belong to the primitive group of Berycoids. With them, however, are a few somewhat more advanced types. The collection in Beirut not only provides material for a more detailed study of the Berycoids and their allies, but also contains a few rare specimens which show that other groups of Acanthopterygians were beginning to appear. There are three Berycoids worthy of immediate brief note, and there are three new genera which seem to represent the beginning of other types of Acanthopterygians.

#### Genus HOPTOPTERYX Agassiz.

*Hoptopteryx spinulosus*, sp. nov. (Pl. IV. fig. 1.)

*Type*.—Nearly complete fish from Sahel Alma; American University of Beirut, no. 102056.

*Specific characters*.—Attaining a length of about 12 cm. Length of head with opercular apparatus equalling about half the maximum depth of the trunk, which exceeds the length from the pectoral arch to the base of the caudal

fin. All the fin-spines and all the fin-rays, except perhaps those of the pectoral fin, bearing minute denticles on their postero-lateral faces. Dorsal fin occupying slightly more than half the length of the back, comprising five very stout ribbed spines and 12 divided rays; the length of the longest spine less than one-third the depth of the trunk at its insertion; anal fin with three or four very stout ribbed spines, which gradually increase to a length not equalling that of the longest dorsal, followed by 10 divided rays. Scales covered with small denticles, which have a more or less extended base.

*Description of specimens.*—The type-specimen shows the nearly complete fish not much distorted. The cranial roof is shown to be ridged as usual in *Hoplopteryx*, and the premaxilla and dentary bear the minute clustered teeth. The operculum (as shown in nos. 102924, 103038) and some of the cheek-plates are ornamented with rows of denticles. The expansion of the cleithrum in the type-specimen is ornamented in chevron-pattern, the acute angles pointed downwards. The rod-like postcleithrum does not reach the ventral border (as seen in no. 100778). The pectoral fin (also seen in no. 100778) is comparatively small and delicate. The pelvic fin, partly shown in the type and some other specimens, has a large spine, which when adpressed reaches less than half-way to the anal fin. The dorsal fin is especially well displayed in the type-specimen, and the front part of the anal is also seen. The ten divided rays of the anal are shown in another specimen (no. 102940), in which it seems to be rather deeper, and there are four spines besides a short basal spine. The large forked caudal fin, with its spinulose rays, is well seen in nos. 103032, 103289. The ornament of the thick deeply overlapping scales is displayed by the type-specimen, in part directly, in part as impressions on the matrix. The scales are often seen to be deeply serrated, with sharp points, and the ornamental denticles are usually broken off in the matrix.

*Remarks.*—This fish appears to be referable to *Hoplopteryx*, but it differs from all the known species of that genus in the presence of minute denticles on the scales and fin-rays and on some of the external bones. Similar denticles occur on the scales of the existing *Beryx splendens*. It is noteworthy that *Hoplopteryx syriacus*, also found

at Sahel Alma, is another comparatively deep-bodied species.

*Locality*.—Sahel Alma.

Genus ACROGASTER Agassiz.

*Acrogaster dayi*, sp. nov. (Pl. IV. fig. 2.)

*Type*.—Nearly complete fish from Hajula; American University of Beirut, no. 108930.

*Specific characters*.—A small species attaining a length of about 6 cm. Length of head with opercular apparatus equalling about two-thirds the maximum depth of the trunk, which is nearly equal to its length from the pectoral arch to the base of the caudal fin. Dorsal fin with five spines and eight or nine divided rays, the distance between its hinder end and the caudal fin not quite equalling the length of its own base line; anal fin with four spines, the longest as long as the longest dorsal spine, and eight divided rays, arising opposite the middle of the dorsal fin.

*Remarks*.—This species differs from the other known species in having a smaller number of divided rays in the dorsal and anal fins.

*Locality*.—Hajula.

Genus PYCNOSTEROIDES, nov.

As *Pycnosterinx*, but the seven or eight dorsal fin-spines scarcely graded beyond the first, and pelvic fin-spine relatively large, reaching at least the anal fin-spines when adpressed to the trunk.

*Pycnosteroides levispinosus* (Hay). (Pl. V. fig. 1.)

1903. *Pycnosterinx levispinosus* O. P. Hay, Bull. Amer. Mus. Nat. Hist. vol. xix, p. 444, pl. xxxvi. fig. 4.

A well-preserved example of this fish from Hajula shown in Pl. V. fig. 1 is about twice as large as the type-specimen. It is evidently not much distorted, and the maximum depth of the trunk is nearly equal to the total length to the base of the caudal fin. The eye is relatively large, and the cleft of the mouth is scarcely oblique. There are about 30 vertebrae, of which 16 are caudal. The fin-spines are all smooth, not grooved as in *Pycnosterinx*. The long, sharply-pointed pelvic fin-spines are well seen, one of them extending backwards beneath the anal fin-

spine. In the dorsal fin the foremost spine seems to be comparatively small, but the seven others do not vary much in size, and cannot have been much exceeded in length by the anterior divided rays. There are 16 well-spaced divided rays, which do not diminish much in size until near the hinder end. The anal fin is a little displaced, but its spines are seen to be smaller than those of the dorsal fin, and the spaced divided rays are only 12 in number. The caudal pedicle is short and stout, and the strong caudal fin cannot have been very deeply forked. The scales are shown to extend over the base of the dorsal and anal fins.

*Locality.*—Hajula.

Genus PHARMACICHTHYS, nov.

A Chaetodontid fish. Head scarcely as long as deep, less deep than the trunk, which is about as deep as long and much laterally compressed, with a forked caudal fin. Abdominal cavity deep, the anterior part of the vertebral column being on the level of the upper margin of the operculum. A triangular supraoccipital crest about as deep as long; mouth relatively small and terminal. Preoperculum and operculum without spines, not serrated, but angle of preoperculum with a few coarse denticulations; few broad branchiostegal rays. Vertebrae 10+14, those of the abdominal region relatively short and without parapophyses; six pairs of long ribs, which extend to the ventral border of the fish. Postcleithrum of pectoral arch rod-shaped, extending to the ventral border; pectoral fins short and broad, with thick articulated rays. Pelvic bones reaching the pectoral arch, and each pelvic fin with a stout spine bearing along its front border a row of recurved denticles. Dorsal fin continuous and much extended; six closely-arranged spines in front, the foremost pointed and barbed like the pelvic fin-spine, the others ending in a soft filament; all the divided rays shorter than the spines. Anal fin also extended. The deeply-forked caudal fin supported chiefly by a symmetrical pair of expanded triangular hypural bones. Scales very thin [character unknown]; no enlarged dermal scutes.

This fish seems to belong to a Cretaceous group which might be ancestral to the Chaetodontiformes and to the



**Balistiformes.** It is interesting as being the earliest known Teleostean in which there is distinct provision for the use of poison in offence or defence. The barbed spines must be thus interpreted. The dorsal barbed spine probably represents the hindmost and longest of the basal fulcra of the Ganoid from which the fish must be descended, the other five dorsal spines seem to be ordinary soft rays which are in process of transformation.

*Pharmacichthys venenifer*, sp. nov. (Pl. V. fig. 2 ; text-fig. 1.)

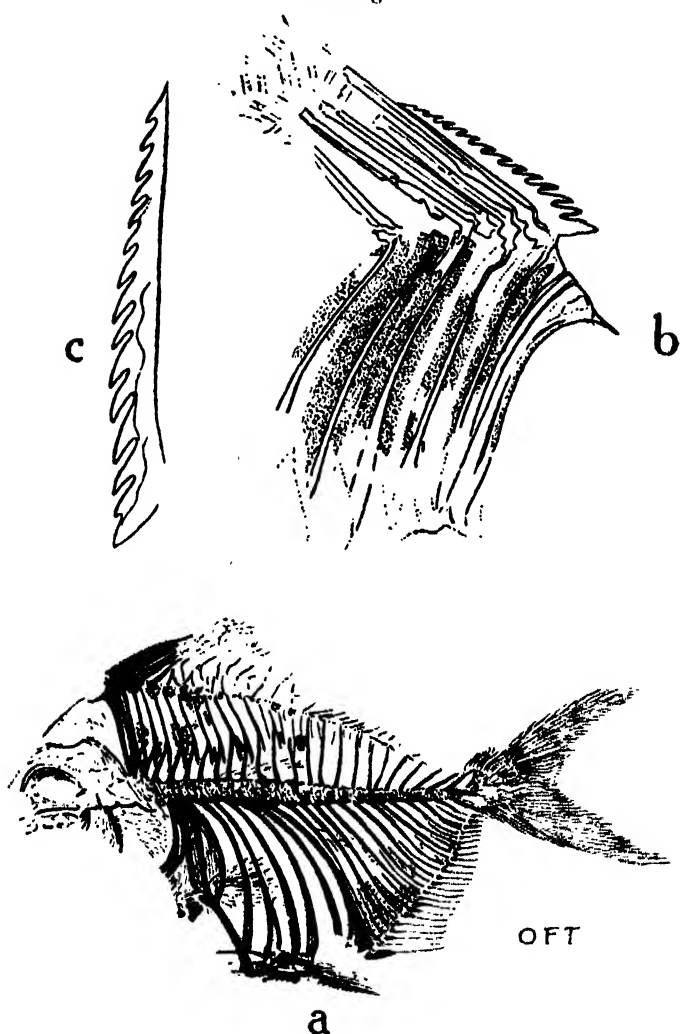
*Type.*—Nearly complete fish from Hakel ; American University of Beirut, nos. 104691, 104699 (counterparts).

*Specific characters.*—Maximum depth of trunk equal to its length to the base of the caudal fin, and the length of the head with opercular apparatus somewhat less. Dorsal fin arising not far from the occipital crest, above the hinder edge of the operculum and extending for about half the length of the back ; from 12 to 14 articulated and divided rays, all a little spaced. Anal fin extending a little further back than the dorsal fin, with one spine and 21 or 22 articulated and divided rays. Each lobe of the caudal fin slender, about half the length of the vertebral axis.

*Description of specimens.*—The type-specimen is about 5.5 cm. long, and the other specimens range in size from this to about 2 cm. in length. They are all shown in side view, and they must have been much laterally compressed fishes, with the head a little thicker than the trunk.

The cranial region of the skull is somewhat shorter than the facial region, which tapers to a sharply-pointed snout. There is a thin triangular supraoccipital crest, about as long as deep. As shown by the parasphenoid in the type and other specimens, the basicranial axis is sinuous, bulging downwards under the braincase, rising in the orbital region, and curving downwards again to the end of the snout. Under the front of the braincase the parasphenoid seems to bear a low longitudinal keel along its lower edge. Some ossification of the sclerotic is always seen. The mouth is short and terminal, and the articulation of the lower jaw is clearly below the front border of the orbit. The dentary bone, as shown in no. 101872

Text-fig. 1.



*Pharmacichthys venenifer*, gen. et sp. nov.; enlarged drawing of type-specimen (a), with spines of dorsal fin further enlarged (b), and barbed dorsal spine much enlarged and restored (c). Upper Cretaceous; Hajula, Mount Lebanon.

(Pl. V. fig. 2), is short and deep and truncated at the symphyseal end ; no teeth are observable. The operculum is deeper than broad, with a gently convex hinder margin ; and the narrow preoperculum, deeply marked by the usual sensory canal, is not much expanded at the angle. Neither is spinous or serrated, but in no. 101872 some crimpings on the angular expansion of the preoperculum seem to end at the hinder margin in a few coarse denticulations. In the same specimen a small suboperculum is seen, and there is clear evidence of six short and broad branchiostegal rays.

The vertebral axis is straight and well ossified, and the long neural and hæmal spines are either vertical or inclined backwards. The 10 abdominal vertebral centra are slightly deeper than long, the 14 caudals about as long as deep and constricted in the middle. All show traces of lateral pitting. There are six pairs of stout curved ribs, which extend downwards to the ventral margin of the fish. Some of these ribs seem to be a little expanded at their articulation with the centra, and there are no indications of parapophyses. The abdominal region is bounded behind by a stout and long slightly-curved postabdominal bone. In the caudal region the hæmal spines are longer than the neurals ; and among the thickened hæmals which support the caudal fin there is a symmetrical pair of expanded triangular hypurals, as in the Percoids. The only remains of intermuscular bones are a few crossing the abdominal neural spines in the type-specimen.

The most conspicuous feature of the pectoral arch is the large coracoid, which is much expanded below where it reaches the ventral margin of the fish, as shown especially well in no. 101872. The rod-shaped post-cleithrum is also always prominent, inclined downwards and backwards to approach the ventral margin above the pelvic fin-supports. The pectoral fin is short and broad, consisting of about a dozen rays, which are closely articulated and finely divided above their short base, and diverge to their distal end at least as far backwards as the fourth rib. One of the pair of pelvic fin-supports is well seen in position in the type-specimen. It is elongate-triangular in shape and slightly more than twice as long as its greatest width at the base of the pelvic fin. As shown in no. 101872, its apex touches the expanded lower end of the pectoral

arch. The pelvic fin is relatively large, its anterior spine being twice as long as the support, and almost reaching the anal fin when adpressed to the trunk. This spine, which is sharply pointed, resembles the foremost spine of the dorsal fin both in size and in bearing a close series of large, stout, recurved denticles along its front border. The articulated rays are also long, and the type-specimen shows that they are at least five in number, perhaps one or two more. The insertion of the pelvic fin on the trunk is well behind that of the pectoral.

The supports of the dorsal and anal fins are remarkably long, and are strengthened by a thin lamina of bone. The extended dorsal fin, which is continuous, arises shortly behind the occipital crest and ends somewhat behind the middle of the trunk, but not so far back as the end of the anal fin. Between its origin and the occiput there are two small free fin-supports, which are expanded and truncated distally on the ridge of the back but do not bear rays. The front spinous part of the fin is deepest, consisting of six stout spines which are closely pressed together. The foremost spine, which bears a close-series of stout recurved denticles along its front border, is pointed and shorter than the others, which are all truncated at their distal end and terminate in a delicate articulated filament. The articulated and divided rays, which are about 14 in number, are much smaller than the spines and more widely spaced. The anal fin is not so well seen in the fossils but, as shown by the type-specimen, it extends from the end of the abdominal region to the base of the caudal pedicle, comprising at least one stout spine and 21 articulated and divided rays. The caudal fin, which is much constricted at its origin and is deeply forked, must have been very powerful. Its marginal rays are especially stout.

In the type-specimen the brown stain in the lower part of the abdominal region has a mottled appearance, as if it represented a covering of thin scales. There are no traces of enlarged scutes or spines.

*Locality*.—Hakel.

#### Genus *PATEROPERCA*, nov.

A Percoid fish. Head as deep as the trunk, which is elongate-fusiform and laterally compressed, with a

rounded caudal fin. Vertebrae  $16+16=32$ ; ribs short, stout, and much curved. Pectoral fins delicate; pelvic fins inserted behind the pectoral insertion, each with one spine and five stout articulated and divided rays. Dorsal fin much extended, with well-separated slender rays, of which the foremost three are short spines; anal fin short-based. Scales smooth and cycloid, extending over the cheek; lateral line not prominent.

This genus is evidently a primitive Percoid, and in the feebly-armed condition of the dorsal fin it resembles the existing *Latilus* and its allies, which live on the bottom of comparatively deep warm seas. In this connection it is interesting to note the strong development of the supraorbital sensory canal in the fossil fish.

*Pateroperca libanica*, sp. nov. (Text-fig. 2.)

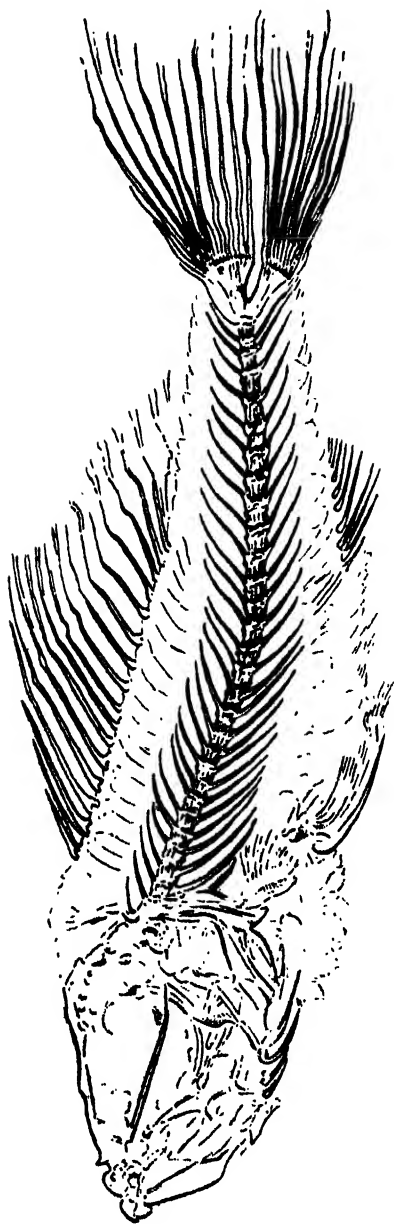
*Type*.—Nearly complete fish from Hajula; American University of Beirut, no. 108906.

*Specific characters*.—Head with opercular apparatus longer than deep, its length also exceeding the maximum depth of the trunk and equalling one-quarter of the total length of the fish. Dorsal fin with three short slender spines in front, two simple articulated rays, and 14 articulated and divided rays; deepest at its anterior end, this maximum depth nearly equalling the depth of the trunk at its insertion. Caudal fin with  $12+12$  articulated and divided rays, its maximum length about equal to the maximum depth of the trunk.

*Description of specimens*.—The type-specimen is a fish 10 cm. in length, preserved in counterpart, with the scales only vaguely shown. A second specimen, incomplete at each end, is more darkly stained with iron and displays the scales both on the trunk and on the cheek.

In the skull the facial region is about twice as long as the cranial region and gradually tapers to a pointed snout, where the ethmoid ossification is remarkably small. The stout frontal bone (seen in the second specimen) is marked at its lateral border with a groove for the supraorbital sensory canal, which opens with large pores. The parasphenoid crossing the orbit is very slender. The articulation of the lower jaw seems to be below the hinder border of the orbit, and a thin lamina of bone immediately below the parasphenoid may be interpreted as a relatively large

Text-fig. 2.



*Patroperra libanica*, gen. et sp. nov. ; drawing of type-specimen, one-and-a-half times nat. size.  
Upper Cretaceous ; Hajula, Mount Lebanon.

entopterygoid. The bones of this region, however, are confused by crushing, and it can only be said that one element, on the side not figured, is suggestive of a Percoid maxilla. No teeth are seen. The preoperculum is best shown in the second specimen. It is sharply bent at the angle, and the lower limb is relatively large; there are a few coarse crimpings at the angle, but, it is uncertain whether any of these end in denticulations at the hinder margin. The operculum is smooth and its hinder margin is not produced into any spine, apparently not even serrated. Below the elongated suboperculum and interoperculum there are traces of broad branchiostegal rays. The vertebræ are not much disturbed in the fossils, and the number in both specimens seems to be 16 in the abdominal, 16 in the caudal region. The centra are well ossified and a little constricted, scarcely longer than deep. The stout, sharply-curved ribs articulate directly with the centra, and do not extend more than half-way towards the ventral margin of the fish. The neural spines in the abdominal region are also short, not extending more than half-way towards the dorsal margin. All the neural spines incline regularly backwards, and in the caudal region the hæmal spines are symmetrical with them. At the end of the tail the hæmals are thickened to support the caudal fin, the lowest three being simple rods, the fourth and fifth (perhaps composite) expanded into a nearly symmetrical pair of elongate-triangular plates, which bear most of the fin-rays. Intermuscular bones are not observable. The pectoral arch and fins are not clearly shown in either fossil, but the elongated pelvic bones are seen to reach the cleithrum. The insertion of the pelvic fins, however, is well behind that of the pectorals. The first pelvic fin-ray is shown to be a spine by its dark colour. It is shorter than the soft rays, of which there appear to be five. The dorsal fin arises above the insertion of the pectoral fins, and extends for about half the length of the back. Its foremost three rays are comparatively small spines, which progressively increase in length until the longest equals about half the maximum depth of the fin. Then follow two simple rays, still progressively longer, but articulated at the apex. The following 14 rays are both articulated and divided in their distal half; the first is the longest, and the others

gradually decrease in length to the end. The whole dorsal fin is remarkably like that of the contemporary *Ctenothrissidæ*, though it differs in the spinous condition of the three foremost rays. The anal fin is imperfectly preserved, but it is clearly short-based and arises opposite the hinder end of the dorsal; its supports seem to indicate about 10 rays. The rounded caudal fin is divided by a narrow gap into an upper and lower half of equal size; there are 11 or 12 stout rays in each half, articulated and bifurcated distally. The scales, as displayed in the second specimen, are smooth and cycloid and regularly arranged, a few extending over the cheek in front of the preoperculum. The lateral line is not observable, but it cannot have been marked by a ridge.

*Locality*.—Hajula.

Genus *PROTOBRAMA*, nov.

A Bramid fish. Head about as long as deep, less deep than the trunk, which is deeply fusiform and much laterally compressed, with a very slender caudal pedicle and a relatively small, though extended, forked caudal fin. Abdominal cavity deep and large, the anterior half of the vertebral column being considerably above the middle line of the trunk. Eye with ossified sclerotic; cleft of mouth horizontal and articulation of lower jaw below the postorbital cheek-plates. Seven or eight broad branchiostegal rays just below the opercular plates. About 60 vertebrae, of which nearly half are abdominal; centra at least as deep as long, those of the caudal pedicle becoming very small; ribs nearly straight and not more than half the depth of the abdominal cavity, the few hindmost especially short. Pectoral fins long and narrow with very slender rays, inserted at the middle of the flank; pelvic fins relatively small, close to the lower end of the pectoral arch. Dorsal and anal fins low and much extended, both arising in the front half of the abdominal region and ending at the beginning of the slender caudal pedicle; rays slender and numerous, the few foremost gradually increasing in length to the longest, behind which the fin gradually decreases in depth backwards. Scales small, most of those of the abdominal region with a strong vertical inner keel, by which the scales of each transverse row are firmly fixed together.



This genus differs from the existing *Bramidæ* in the horizontal cleft of its mouth and in the greater number of its vertebræ.

*Protobrama avus*, sp. nov. (Pl. VI. fig. 1 ; text-fig. 3.)

*Type*.—Nearly complete fish from Hajula ; American University of Beirut, nos. 108390–91.

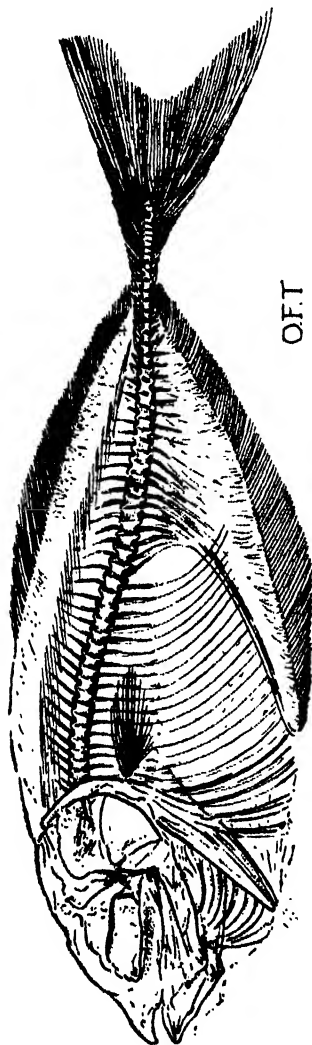
*Specific characters*.—Length of head with opercular apparatus slightly less than the maximum depth of the trunk, and forming a little more than one-quarter of the total length of the fish. Length of caudal fin somewhat less than that of the head with opercular apparatus. Scales largest and stoutest behind and below the lower limb of the cleithrum.

*Description of type-specimen*.—This species is known only by the type-specimen, which measures about 9 cm. in total length and 2·7 cm. in maximum depth of the trunk. It is nearly complete and is preserved in counterpart, but it is too feebly stained by oxide of iron to be clearly observable in all parts. Some confusion is also caused in the abdominal region by the overlying riblets of the scales.

The head-bones are crushed and broken, and there is no trace of a supraoccipital crest or of any covering of scales. The horizontal direction of the cleft of the mouth is distinct, and the articulation of the lower jaw is seen behind the orbit. No teeth are observable. The upper and lower halves of the ossified sclerotic of the eye are conspicuous, but they seem to be a little crushed together. Below the broken opercular plates, which resemble those of *Brama*, seven or eight broad branchiostegal rays occur in place, also as in *Brama*. The high position of the vertebral column in the abdominal region is well seen, and it is only a little dislocated at the front end where it is crushed under the pectoral arch. There are 26 vertebræ in the abdominal region and at least 30 in the caudal region, where the terminal eight or nine become relatively small between the two lobes of the caudal fin. The centra are well ossified, and most of them are about as deep as long. The ribs are not expanded, and none of them extend more than half-way to the ventral border ; the six hinder ribs are comparatively short. The neural spines of the abdominal vertebræ are inclined gently backwards

as far as the twentieth, but those of the six hindmost abdominal and the foremost six caudal vertebræ are inclined forwards. The six foremost hæmal spines are

Text-fig. 3.



*Protobranchia arua*, gen. et sp. nov.; drawing of type-specimen, one-and-a-half times nat. size.  
Upper Cretaceous; Hajula, Mount Lebanon.

also inclined forwards, but the rest of the caudal neural and hæmal spines, which are shorter, are nearly vertical or inclined backwards. A few very short, backwardly

bent hæmal arches are seen below the small vertebræ clasped by the caudal fin. Very delicate short inter-muscular bones lie across some of the neural spines in the abdominal region. The lower part of the pectoral arch is remarkably stout, and the pectoral fin is raised to the middle of the flank, at the level of the lower half of the operculum. This fin is long and narrow, and consists of very delicate rays closely pressed together. Its length is about equal to that of 14 vertebræ, and it tapers a little behind to a blunt end. The pelvic fins are probably represented by some relatively small vague markings behind the lower end of the pectoral arch. The extended dorsal and anal fins arise far forwards in the abdominal region and end at the beginning of the slender caudal pedicle. Their very slender rays are depressed in the fossil, and they are not sufficiently clear to determine whether they are simple or divided distally. Both fins seem to be less elevated than in the existing *Bramidæ* and there are no traces of scales covering the base.

The only remains of scales are a series of about 20 transverse lines crossing the abdominal region below the vertebral column. These are evidently the ridges which strengthened and united the scales of the several transverse rows. They indicate that the ordinary scales of the flank were relatively small, but that the scales of the five short rows below the lower end of the pectoral arch were much larger and thicker, forming a kind of pectoral plastron.

*Remarks.*—It is interesting to compare the skeleton of the fossil *Protobrama* with that of the existing *Pterycombus brama* which is described and figured by R. Collett (2). In the existing fish the abdominal cavity is relatively much smaller, and the ribs are expanded at their upper end. All the neural and hæmal spines are inclined backwards in regular series; and the caudal fin is not extended to include a considerable series of the terminal vertebræ.

*Locality.*—Hajula.

## INCERTÆ SEDIS.

Genus CÆLORHYNCHUS Agassiz.

*Cælorhynchus libanicus*, sp. nov. (Pl. VI. fig. 2.)

*Type.*—Rostrum from Hajula; American University of Beirut, no. 108966.

*Specific characters.*—Rostrum as in *C. cretaceus*, but more slender and depressed.

*Description of specimens.*—The type-specimen is 12·5 cm. in length, and exhibits the finely-pointed apex. It is shown in upper or lower view, and also in cross-section at the basal end, which measures half a centimetre in width. In superficial aspect the ridges are smooth and well separated by grooves, as in *C. cretaceus*. From the smooth apical point three longitudinal ridges extend backwards until at 12 mm. from the apex the middle ridge bifurcates, one of its divisions soon bifurcates again, and towards the base nine, ten, and eleven ridges become visible. Close to the base also a longitudinal median depression appears, and in the cross-section this depression is shown to be due to the usual basal subdivision into a paired structure. The depressed shape of the pair of ovoid cross-sections may be partly due to crushing, but even allowing for this the rostrum seems to have been less rounded than that of other known species, and the central cavity of each half must have been relatively small.

A second fragment of rostrum, also from Hajula, shows the same depressed cross-section at a position much nearer the apex, and exhibits again the well-spaced longitudinal ridges.

A third more fragmentary specimen of rostrum, not far from the apex, shows the same specific characters. It was found with a collection of fish-remains labelled as obtained from Hakel.

*Remarks.*—The form of rostrum named *Cælorhynchus* has been definitely recognised in *Blochius*, a fish of which nearly complete specimens have been found in the Upper Eocene of Monte Bolca, near Verona, in northern Italy. This genus is usually regarded as a Xiphioid or sword-fish (1) and, if this determination is correct, the occurrence of so highly specialised an Acanthopterygian in the Cretaceous is very remarkable. So far as known, however, *Blochius* does not exhibit the characters of a Xiphioid either in its tail or the vertebral column, and the osteology of the head is not observable. Nothing is known in this Eocene fish to prevent its reference to the same group as *Pelargorhynchus* from the Upper Cretaceous of Westphalia. It exhibits the same type of vertebral centra, tail, and

scales, and only differs in the smaller number of its vertebrae, the absence of pelvic fins, and the spinous character of its dorsal and anal fin-rays. Such differences might be expected to arise during the evolution of a *Pelagorhynchus*-like fish into *Blochius* between the Upper Cretaceous and Upper Eocene. It should be noted that another physostomous fish, *Notacanthus*, is already known to possess spaced spinous rays in its extended dorsal fin. The only known specimen of *Pelagorhynchus* with the head shows the snout projecting beyond the symphysis of the lower jaw, but the extent of this projection is uncertain.

*Localities*.—Hajula and Hakel.

## MALACOPTERYGIANS.

### Genus *HAHELIA*, nov.

A Scopeloid (or Myctophid) fish. Head large and trunk elongated and flexible. Mandibular suspensorium nearly vertical, and articulation of mandible beneath the hinder border of the large orbit; maxilla not expanded behind; teeth minute. Vertebral centra not longer than deep, longitudinally striated, between 50 and 60 in total number; ribs slender and not reaching the ventral border; separate slender neural spines in the abdominal region. Pectoral fins inserted close to the ventral border, about as large as the pelvic fins but with more delicate rays; dorsal and anal fins acuminate, at least as deep as long, but with numerous crowded delicate rays; anal arising opposite or just behind the hinder end of the dorsal fin; caudal fin large, forked, with broad rounded lobes. Scales small and all very thin and uniform.

This genus differs from the contemporary *Sardinius* in its larger head, more slender trunk, smaller pectoral fins, less extended anal fin, and smaller smooth scales.

### *Hakelia laticauda* (Pictet).

1850. *Clupea laticauda* F. J. Pictet. Poiss. Foss. Mt. Liban., p. 39, pl. vii., fig. 3.  
 1895. *Dactyloporon parvulus* D. G. Kramberger. Djela Jugoslav. Akad. vol. xvi. p. 41, pl. vii. fig. 3. (Middle portion of small trunk; Trieste Museum).  
 \*1898. *Clupea laticauda* A. S. Woodward. Ann. & Mag. Nat. Hist. (7) vol. ii. p. 488 ("not *Clupea*").

*Type*.—Imperfect distorted fish; Geneva Museum.

*Specific characters.*—The type-species, attaining a length of at least 16 cm., but usually smaller. Head with opercular apparatus occupying about one-third of the length of the fish to the base of the caudal fin, its length equalling about twice the maximum depth of the trunk. Vertebrae about 35 in the abdominal, 25 in the caudal region. Dorsal fin with 20 rays, arising somewhat nearer to the occiput than to the caudal fin, the length of its longest ray equalling the depth of the trunk at its insertion; anal fin usually with 14, sometimes with 15–16 rays, the length of its longest equalling the depth of the tail at its insertion.

*Description of specimens.*—All the examples of this species are more or less distorted, like the type-specimen, and the neural arches in the abdominal region are often separated from the vertebral centra (*e. g.*, nos. 100701, 101375, 104269). The large orbit is sometimes marked by a black stain from the soft parts (nos. 105065–105600, 108547). The opercular apparatus is shown to be always smooth, and the delicate branchiostegal rays are at least 25 in number (nos. 101375, 105776).<sup>\*</sup> There are intermuscular bones in the dorso-abdominal region and in the caudal region as far as the end of the dorsal and the beginning of the anal fin. The pectoral fins have a rather extended base on the flank, and the pelvic fins are inserted nearly as far forwards as the origin of the dorsal. The fulcral rays, and the elongated enlarged ridge-scale at the origin of the caudal fin above and below, are especially well seen in no. 100701. The small rounded scales are best shown in the darker matrix (nos. 108225, 108547, 105065–105600); they seem to have been smooth and a little tumid, uniform, and deeply overlapping.

*Localities.*—Hakel and Hajula.

Genus *LEPTOTRACHELUS* W. von der Marck.

*Leptotrachelus gracilis* Davis.

A well-preserved specimen of *Leptotrachelus triqueter* in the British Museum (no. 49540), has already been described as showing the oldest known distensible stomach containing a comparatively large fish (8, p. 68, text-fig. 16). In the American University, Beirut, there are four specimens of *L. gracilis* (nos. 100046, 100453–100779, 101932, 102228) which exhibit similar evidence of a distensible stomach.

It may be added that some specimens of *Prionolepi cataphractus* seem to show that the stomach was also distensible in this species.

Genus *ANGUILLAVUS* Hay.

*Anguillavus bathshebæ* Hay. (Pl. VII. fig. 1.)

Another example of this primitive eel, which I bought in a shop at Jebail, is nearly complete, lacking only the pectoral fins and part of the dorsal and caudal fins. Its total length is 14 cm., and the length of the head is 1.5 cm., with opercular apparatus about 1.8 cm. The skull and the anterior part of the abdominal region are displayed from above, the rest of the fish in side-view. The head is so much crushed that it cannot be studied in detail, but it is evidently that of a typical eel. The elongated rostrum, which ends bluntly in front, is flanked on either side by a stout flattened maxilla. The symphysial ends of the mandibular rami project a little further forwards; and the ramus of the right side is sufficiently well-preserved to show an angulated coronoid process. Teeth are not preserved. There are traces of eight or nine slender branchiostegal rays, of which five are much elongated to curve round the back of the operculum. The strong but slender cleithra behind the branchial region are sigmoidally bent and taper gradually to a point at each end. There are slightly more than 100 vertebræ, perhaps 110, and so far as they can be observed they resemble those of a modern eel (5). Most of the abdominal vertebræ exhibit the short triangular parapophyses which bear short and slender ribs. The caudal vertebræ in side view show similar parapophyses bearing the hæmal spines, and also the low and elongated neural arches, each with a neural spine inclined upwards and backwards from its hinder angle. The neural and hæmal spines are a little thickened at their distal end, and the neurals are considerably smaller than their opposing hæmals. A few stout hæmals are closely pressed together as a fan-shaped mass at the base of the caudal fin. There seem to be a few traces of intermuscular bones. The pair of pelvic fins (F), with their supports, are well seen below the 43rd to 45th vertebræ, which they equal in length. Each support tapers upwards and forwards and is truncated at its wider end, which articulates with about

eight fin-rays. The beginning of the dorsal fin is not seen, but fragments suggest that it arose at the middle of the abdominal region; the anal is shown to arise opposite the 56th vertebra, so that the abdominal and caudal regions are about equal in length. The caudal fin is clearly separate, with about 16 rays, which are much longer and stouter than those of the other median fins. It is fringed at the base both above and below with a few short delicate rays. Part of the body is indicated by a ferruginous stain, but there are no traces of scales.

The proportions of this new fossil do not agree completely with those of the type-specimen of *A. bathshebæ* as described by Hay, but allowance must be made for crushing and imperfections in preservation. There cannot be much doubt as to its specific identity.

Genus *HAJULIA*, nov.

An Albulid fish. Head short and stout, trunk elongated and laterally compressed. Articulation of mandible beneath hinder part of orbit; maxilla straight, with a single large supramaxilla; maxillary teeth small, slender, conical, in regular close series; dentary teeth much larger, each a stout cone with enamelled apex; crushing teeth within both jaws, probably on the parasphenoid and basihyal. Branchiostegal rays slender and spaced. Vertebrae about 50 in number, half caudal; vertebral centra about as long as deep, with striated sides; ribs long, but not completely encircling the trunk. Pectoral fins with wide base on flank just above ventral border; pelvic fins opposite dorsal fin, which is elongated with well-spaced rays, but occupies less than half of the back; anal fin behind dorsal, relatively small; caudal fin large and forked. Scales in regular series, small, thin, smooth, and deeply overlapping.

This genus seems to be related to *Istieus*, but with a less elongated trunk and less extended dorsal fin.

*Hajulia multidentis*, sp. nov. (Pl. VI. fig. 3.)

*Type*.—Nearly complete fish from Hakel; American University of Beirut, no. 100509.

*Specific characters*.—The type-species attaining a length of 12 cm., but usually smaller. Length of head with opercular apparatus considerably exceeding maximum



depth of trunk, and contained about three-and-a-half times in total length of fish to base of caudal fin. Pelvic fins opposed to the front part of the dorsal, which comprises about 20 rays and occupies the middle third of the back; anal fin with seven, rarely eight, rays; caudal fin with a few fine fulcral rays and a small elongated ridge-scale at the base above and below.

*Description of specimens.*—The cranial roof, with its slender truncated rostrum, is shown in no. 101488, and the parietal bones clearly meet in the middle line. The dupeoid upper jaw, with its straight maxilla and single elongated supramaxilla, is especially well seen in no. 103055. The teeth, both of the maxilla and dentary, are shown in the type-specimen, and there are traces of the inner crushing teeth in this and in nos. 101680, 103055, C. 187, C. 207. The crushing teeth appear to be on the parasphenoid in nos. 101680, 102529, and on the basihyal in no. 103055. The type- and other specimens show that the dorsal fin is not acuminate, but gradually diminishes in height from about the third ray backwards. Between the rays of this fin and their ordinary supports there appear to be the short intercalated pieces which are so characteristic of the Amioid fishes (see especially no. 107632).

*Localities.*—Hakel and Hajula.

## GANOIDS.

### Genus PETALOPTERYX Pictet.

#### *Petalopteryx syriacus* Pictet.

The second known specimen of this fish from Hakel (American University of Beirut, no. C. 289) shows that the genus *Petalopteryx* is not identical with *Aphanepygus*, as I once supposed it to be (6, pt. iii. p. 181). The newly recognised specimen is the middle portion of a fish showing the dorsal and pelvic fins. The extended dorsal fin, so far as preserved, exhibits 25 stout rays in a length of 7 cm. Each ray consists of a long undivided basal portion and an articulated and divided distal portion. The foremost ray is longest, so that the fin rises to a point in front. There are a few basal fulcra which gradually increase in length backwards; and there are fringing fulcra, which are largest below and rapidly decrease in size upwards. The pelvic fins are inserted nearly opposite the 25th

dorsal fin-ray, and all their rays are both articulated and finely divided distally. The rhombic scales are regularly arranged and do not exhibit any subdivision. They are smooth and bear traces of a very fine serration of their hinder border.

The new specimen, therefore, and the type-specimen as re-described in 1898, prove that the generic definition given in the British Museum Catalogue (pt. iii. p. 181) applies only to *Aphanepygus*, not to *Petalopteryx*. *Aphanepygus* is represented by the two species *A. elegans* Bassani, from the Island of Lesina, Dalmatia, and *A. dorsalis* (Davis), from Hakel, Mt. Lebanon. *Petalopteryx* is now seen to be more closely related to *Neorhombolepis*, from the English Chalk and Wealden.

Genus COCCODUS Pictet.

*Coccodus insignis* Hay.

A series of good specimens of *Coccodus insignis* from Hajula adds to our knowledge of the genus as well as of the species.

The middle portion of the tuberculated cranial roof is gently arched from side to side, as usual in the Pycnodonts. The snout is a little elongated and sharply pointed. The vomer is long and narrow, and bears three longitudinal rows of teeth, which are closely pressed together. Very small teeth are sometimes intercalated between the middle row and the marginal rows. The teeth of the middle row, which are the largest, are triangular in shape, and crimped at the base of the straight posterior border. A pit in the summit of the crown is also crimped, and has a small tubercle in the middle. All the teeth, indeed, are more or less crimped, with a pit at the summit. Two longitudinal rows of teeth are conspicuous in the splenial of the lower jaw. Those of the inner row are about twice as wide as long, scarcely pitted but with a small indent near the outer end; they are arranged with the long axis oblique. The teeth of the outer row are not much wider than long, and are marked with a crimped indentation on the inner half of the crown. There are relatively small prehensile teeth in the dentary bone.

Compared with those of other Pycnodonts, the vertebrae are remarkably few, only eight or nine in the abdominal

region, nine in the caudal region to the end of the caudal pedicle, and eight with thickened hæmal spines crowded to support the caudal fin. The short ribs are stout and nearly straight. The neural spines in the abdominal region, and both neurals and hæmals in the caudal region, bear an anterior laminar expansion in their proximal half.

The two halves of the pectoral arch are firmly fused in the middle line below. The ascending ramus is much expanded into a thin plate. The falcate spine is shown to be solid. The pectoral fin is inserted below this spine. It is relatively large, consisting of about 28 delicate rays, which are distantly articulated but do not bifurcate until close to the distal end. The pelvic fins are comparatively small, and inserted not far in advance of the anal. Each consists of four well-spaced rays, which are distantly articulated and bifurcate twice distally. The dorsal fin is very short, with only 10 winged supports. The anal fin, which arises opposite the hinder end of the dorsal, is still shorter, with eight supports; its delicate rays are distally articulated and bifurcate two or three times distally. The rays when adpressed to the trunk reach the caudal fin. The caudal fin is long and rounded, and its middle rays are very finely divided distally. It is strengthened by about nine fuleral rays at the base above and below.

#### Genus *MACROPOMOIDES*, nov.

Differing from *Macropoma* in the club-shaped expansion of the distal end of the three foremost rays of the anterior dorsal fin, which increase progressively in length from the first, which is not longer than the eighth or last ray. Scales as in *Macropoma*.

Being known only by one fragment, this genus cannot yet be satisfactorily defined, but it is interesting as showing that at least one Cœlacanth was included in the Cretaceous fish fauna of the Lebanon. The club-shaped expansion of the fin-rays among Cœlacanths attains its maximum in the Upper Triassic genus *Graphiurus* Kner.

*Macropomoides orientalis*, sp. nov. (Text-fig. 4.)

*Type*.—Portion of the back showing the two dorsal fins and some scales from Hajula; American University of Beirut.

*Specific characters.*—The longest rays of the two dorsal fins nearly equal in length, and equalling about half the distance between the points of origin of these fins. Tuberculation of dorsal scales very coarse.

*Description of specimen.*—The type-specimen seems to be a fragment of a well-preserved fish, and the dorsal fins occupy their original relative positions. In the anterior dorsal fin the eight rays are distinctly shown, the first four crowded together, the others more divergent. The terminal club-shaped expansion of the first three gradu-

Text-fig. 4.



*Macropomoides orientalis*, gen. et sp. nov.; drawing of dorsal fins of type-specimen, much reduced. Upper Cretaceous; Hajula, Mount Lebanon.

ated rays is closely articulated and tapers to a pointed apex. The fourth ray is the longest, and its terminal articulated portion is not expanded. The hinder four rays gradually decrease in length and are comparatively slender. The upwardly-pointed denticles are not well seen. In the posterior dorsal fin the rays are comparatively slender, as usual, and do not bear denticles. There are 10 long rays with smaller graduated rays in front and behind, and the little basal lobe is conspicuous. The coarse ornament of the scales is best seen near the base of this fin.

*Locality.*—Hajula.

## ELASMOBRANCHS.

Genus SCAPANORHYNCHUS A. S. Woodward.

- *Scapanorhynchus lewisi* (Davis).

This species is still known only from Sahel Alma. One nearly complete fish (no. 100339) shows its slender elongated shape, and is interesting because the spiral valve of the intestine is made conspicuous by the hard remains of food. Another specimen (no. 100178) exhibits the spines of a cidarid Echinoid in the position of the stomach, indicating that *Scapanorhynchus* fed on the bottom of the sea like its surviving representative off Japan, the so-called *Mitsukurina*. The shovel-shaped snout is evidently adapted for stirring up the mud in search of food.

Genus OTODUS Agassiz.

*Otodus sulcatus* Geinitz.

The large Lamnid sharks are almost unknown in the Cretaceous fauna of the Lebanon. Hay records a single tooth from Hajula much resembling the tooth from the Cenomanian of Saxony, named *Otodus sulcatus* by Geinitz. There is only one similar tooth, also from Hajula, in the American University of Beirut (no. 108936).

Genus SCLERORHYNCHUS A. S. Woodward.

*Sclerorhynchus hiram* Hay.

One nearly complete specimen of this species, obtained at Hajula in 1926, shows the general proportions of the fish, with the remarkable attenuation of the tail. It lacks the front end of the rostrum, but gives the following measurements :—

Width of rostrum at beginning of free blade . . . .	4.5 cm.
„ „ median rostral cartilage at same . . . . .	2 cm.
Distance from free blade of rostrum to pectoral arch . . . . .	12.5 cm.
Width of pectoral arch . . . . .	6 cm.
Distance from front of pectoral arch to pelvic arch . . . . .	6 cm.
Width of pelvic arch . . . . .	7 cm.
Length of vertebral column behind pelvic arch . . . .	34 cm.

The lateral rostral cartilages taper a little backwards to their contact with the inner side of the nasal capsules, which are comparatively small. There is little or no prepalatine cartilage at the antero-external angle of the nasal capsule, but the separate elongate-triangular post-palatine cartilage is large and extends outwards nearly to the margin of the head (no. 108759). The width of the cartilages of the mouth is about equal to the width of the pectoral arch, and the lower jaw as usual is stouter than the upper jaw. The teeth resemble those of the type-species, *S. atavus* (7), except that they appear to be smoother. They are stoutest and least elongated at the symphysis of the jaw, and smallest and most attenuated at the lateral angle (no. 108759). The stout branchial arches are always well shown in the fossils, and the fifth pair is not much smaller than the others. They all bear radial cartilages.

All the vertebræ are well calcified, with a stout double cone which shows as a wide rim at each end, and the secondary laminae are concentric (tectospondylic). They are deeper than long as far as the beginning of the slender end of the tail, in which they are about as long as deep and with little secondary calcification. They cannot be counted exactly, but there are about 20 between the pectoral and pelvic arches, and at least 120 from the pelvic arch to the beginning of the slender tail, which includes more than 50. In two specimens (nos. 108728, 109126) the neural arches in the anterior abdominal region are shown to be very massive, with small tapering neural spines which are sharply inclined backwards. Slender ribs are seen in several specimens, and they occur far back near the tail. The axial skeleton of the trunk, however, is much obscured by extensive fossilisation of the muscles, which occurs in most specimens.

The broad pectoral arch is usually crushed and obscure, but the free pointed end of its ascending portion is seen on one side in no. 108734. Parts of the pectoral fin are shown in several specimens and it is complete in no. 109126. Its nearly straight anterior margin is a direct continuation outwards and backwards of the margin of the head, and is similarly strengthened by a dense cluster of small rounded shagreen granules, which are irregularly arranged and become fewer and smaller on the anterior margin of

the narrow distal strip of the fin beyond the supporting cartilages. The end of the clustered shagreen marks the apex of the fin, which is about two-thirds as wide as long. Its postero-external edge is gently rounded. The fin extends forwards as far as the second branchial arch, and its anterior third is supported by the propterygium, which is produced forwards as a slender tapering continuous cartilage. The propterygium bears a series of 18 basal rods of cartilage, the uppermost six divergent and curved forwards, the rest straight and closely arranged. The middle part of the fin is supported by the mesopterygium, which is only a little expanded distally and bears six or seven of the close series of basal rods. The hinder half of the fin is supported by the metapterygium, which is produced backwards as a slender tapering rod and is subdivided in its distal half by cross-joints into four elongated segments and one very small terminal segment. It bears 32 of the basal rods, which diminish in size and gradually become directed backwards distally (see no. 108759). Of the cartilages in the fin-membrane the basal rods just mentioned are much the longest, those borne by the mesopterygium extending one-third of the width of the fin-membrane. The six foremost divergent rods and the following five or six straight rods have only a small simple piece of cartilage interposed between them and the edge of the fin; but for the greater part of the rest of the fin each basal rod is continued by two short simple rods and then by a pair of more slender rods, which are first subdivided into three, and finally into two segments. At the extreme posterior end of the fin only one small simple segment is interposed between the basal rod and the pair of rods. The distal ends of all the terminal cartilages are truncated, as if they have been opposed to other little cartilages which remained uncalcified and so are not shown in the fossil. The only evidence for the short extension of the fin-membrane beyond the cartilages preserved is afforded by the shagreen granules along the anterior border already mentioned.

The pelvic arch is a straight slender bar of cartilage with a short prepubic process at each extremity (no. 105443); and the pelvic fin is only about half as long and half as wide as the pectoral fin. As in the latter, the anterior border of the pelvic fin is strengthened by a

narrow cluster of smooth rounded shagreen-granules, which is always displaced distally in the fossils but must have extended along membrane beyond the supporting cartilages. The foremost basal piece of radial cartilage is comparatively thick and seems to articulate directly with the pelvic arch. It expands to its distal end, where it bears three rods of cartilages of the second series, the foremost perhaps not segmented off. The other basal rods of cartilage, from 25 to 30 in number, are borne by the slender elongated basipterygium. As in the pectoral fin, most of these basal rods are continued by two successive short simple rods of cartilage, which end abruptly and do not seem to have been followed by double rods. The distal cartilages of both paired fins are often displaced or folded over in the fossils.

The median fins are not certainly known, but there seems to be a vague trace of a dorsal near the end of the tail, and a twist in the vertebral column in one specimen where the tail becomes very slender may be due to the weight of a caudal fin when the fish was drifting before burial.

The denticles along the edge of the rostrum have already been described by Hay, but it must be added that they vary much in size in different individuals. They have a small pulp-cavity, though it is closed below, and their rounded base is sometimes slightly crimped round the edge. They diminish in size towards the base of the free blade, and pass more or less gradually into the smaller shagreen-granules on the edge of the soft parts. These granules, which have a stellate base and smooth surface, and exhibit the pulp-cavity when they are broken, form a dense narrow cluster along the sides of the head. A few of them are arranged in two or three longitudinal rows on the soft parts on each side of the base of the rostrum, and a sparse paired series is sometimes seen along the middle of the rostrum itself, apparently on the lower face. A cluster of similar granules has already been mentioned on the front margin of the paired fins, and it is seen along part of the margin of the tail even to its fine extremity. The dermal armature of the trunk is not easily observed, owing to the fossilisation of the muscles, but it seems to be restricted to a single longitudinal series of smooth recurved hooklets along the middle



of the back. Each hooklet is fixed on an ovoid base, which is not crimped, and the average size is about that of the hooklets on the edge of the rostrum. They are sometimes seen far along the tail.

A crustacean is seen in the region of the stomach of one specimen, and there is other evidence that crustacea formed the food of *Sclerorhynchus*.

*Remarks.*—The foregoing description shows that the trunk ascribed by Hay to *Sclerorhynchus* (3, p. 398, pl. xxiv. fig. 1) does not belong to this fish, while the fragment described by him as the type-specimen of *Rhinobatus eretes* (3, p. 404, pl. xxiv. fig. 2) is certainly an example of it. The cluster of shagreen on the sides of the tail has already been noted in the typical *S. atavus*.

*Locality.*—Hajula.

#### Genus CYCLOBATIS Egerton.

*Cyclobatis longicaudatus*, sp. nov. (Pl. VII. fig. 2.)

*Type.*—Caudal region from Hakel ; American University of Beirut, no. C. 413.

*Specific characters.*—Disk about as broad as long ; trunk nearly half as broad as long ; each pectoral fin with 50 or 51 rays. Slender tail extending beyond the disk to a length equalling nearly twice the length of the pelvic fins ; its basal portion armoured with a single close series of long-based, backwardly-pointing, hooked spines.

*Description of specimens.*—This form of *Cyclobatis* was noticed, without a specific name, in 1889, in the 'British Museum Catalogue of Fossil Fishes' (part 1, p. 156). It is now represented at Beirut by good examples both from Hakel and from Hajula. Its distinctive feature, the long tail, is especially well seen in the type-specimen (Pl. VII. fig. 2).

*Localities.*—Hakel and Hajula.

#### SUMMARY.

The remarkable variety of the Upper Cretaceous Teleostean fishes has already suggested that the distinct groups may have been descended from different series of the Jurassic Ganoids. This variety is shown to be even greater than hitherto supposed, by the fishes from the Lebanon now described. *Pharmacichthys* seems to be well advanced in the direction of the Chaetodonts and Balistids, and is interesting as showing for the first time

that the fin-spines of the Acanthopterygians originated partly from the basal fulcra of the fins of Ganoids, partly from the ordinary soft fin-rays. *Pateroperca* is a simple ancestral Percoid so much resembling the existing Latilidæ and their allies that these deep-water fishes may probably be regarded as primitive survivals rather than as degenerate forms. *Protobrama* exhibits the characteristic scales of the existing Bramidæ and evidently indicate that they are directly inherited from a rhombic-scaled Ganoid in which they had the usual peg-and-socket articulation. These fishes are all very distinct from the Berycoids, which form the greater part of the Acanthopterygians in the Upper Cretaceous, found both in the Lebanon and elsewhere. The rostral spine named *Cælorhynchus*, which is now recorded from both Hajula and Hakel, is sometimes referred to a Xiphioid Teleostean or sword-fish, which is too specialised a type to be expected in the Upper Cretaceous. Further consideration, however, suggests that it may belong to a physostomous Teleostean like *Pelargorhynchus*, of which nearly complete skeletons occur in the Upper Cretaceous of Westphalia. The primitive Clupeoids of such families as the Elopidae and Albulidae were as well separated from the Clupeidae in the Upper Cretaceous as they are at the present day. *Hajulia* is an interesting addition to the Albulid group. *Hakelia* seems to be a new Scopeloid (=Myctophid). Among the Ganoids the highly specialised Pycnodont *coccodus* is worthy of more extended study than that which has provided the new facts here published. The fragment of a *Macropoma*-like Ganoid is an interesting addition to the Lebanon fauna. Among Elasmobranchs, *Sclerorhynchus* adds much to our knowledge of the beginning of the saw-fishes.

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## EXPLANATION OF THE PLATES.

## PLATE III.

- Fig. 1.* Village of Hajula, Mount Lebanon, distant view showing cultivation terraces.
- Fig. 2.* Collecting fossil fishes in the limestone at Hajula.
- Photographs by Prof. Ely Day.

## PLATE IV.

- Fig. 1.* *Hoplopteryx spinulosus*, sp. nov.; right side view, nearly nat. size. Sahel Alma.
- Fig. 2.* *Acrogaster dayi*, sp. nov.; left side view, nat. size. Hajula.

## PLATE V.

- Fig. 1.* *Pycnosteroides levispinosus* (Hay); left side view, nat. size. Hajula.
- Fig. 2.* *Pharmacichthys venenifer*, gen. et sp. nov.; left side view of type-specimen slightly enlarged. Hakel.

## PLATE VI.

- Fig. 1.* *Protobrama avus*, gen. et sp. nov.; right side view, nat. size. Hajula.
- Fig. 2.* *Caelorhynchus libanicus*, sp. nov.; rostrum two-thirds nat. size. Hajula.
- Fig. 3.* *Hajulia multidentis*, gen. et sp. nov.; right side view, about three-quarters nat. size. Hakel.

## PLATE VII.

- Fig. 1.* *Anguillavus bathshebae* Hay; nearly complete fish, about three-quarters nat. size. F. pelvic fins. Hajula.
- Fig. 2.* *Cyclobatis longicaudatus*, sp. nov.; pelvic fins and tail, nearly nat. size. Hajula.

## XLVI.—Notes on the Jurassic Flora of Yorkshire.

By TOM M. HARRIS, University of Reading.

1. *Ptilophyllum caytonense*, sp. n. (Figs. 1 & 2.)

*Type-specimen*, V. 26756 (figs. 1 & 2); *Geol. Dept.*, Brit. Mus. (Nat. Hist.).

*Age*.—Middle Estuarine (Bajocian).

*Locality*.—Redcliff Rocks, Cayton Bay, Yorkshire. Collected in 1938 by F. M. Wonnacott.

*Diagnosis*.—Leaf about 1.5 cm. wide. Pinnæ separated by narrow gaps. Apex of pinnæ obtusely pointed, lower basal angle rounded and not decurrent, upper basal angle slightly swollen. Lamina flat, its substance thick, veins distinct on both sides; upper surface not showing longitudinal grooves other than veins, both sides clearly showing the bulging surfaces of the epidermal cells.

Cuticle thick (upper  $3\mu$ , lower  $2\mu$ ), showing uniform cells with very sinuous walls, course of veins indistinct; lower showing stomates in longitudinal bands between the veins, stomates rather sparse, bands occupied by two or, occasionally, three rows. Epidermal cells of underside with sinuous walls, outlines rather obscurely marked except near the pinna-margins, where they become more like those of the upper side. Guard-cells sunk, subsidiary cells rather small, stomatal aperture usually protected by broad papillæ of the subsidiary cells. Surface of epidermal cells bulging, but seldom to such an extent as to form a papilla with distinct margins. Occasional papillæ present both along and between veins.

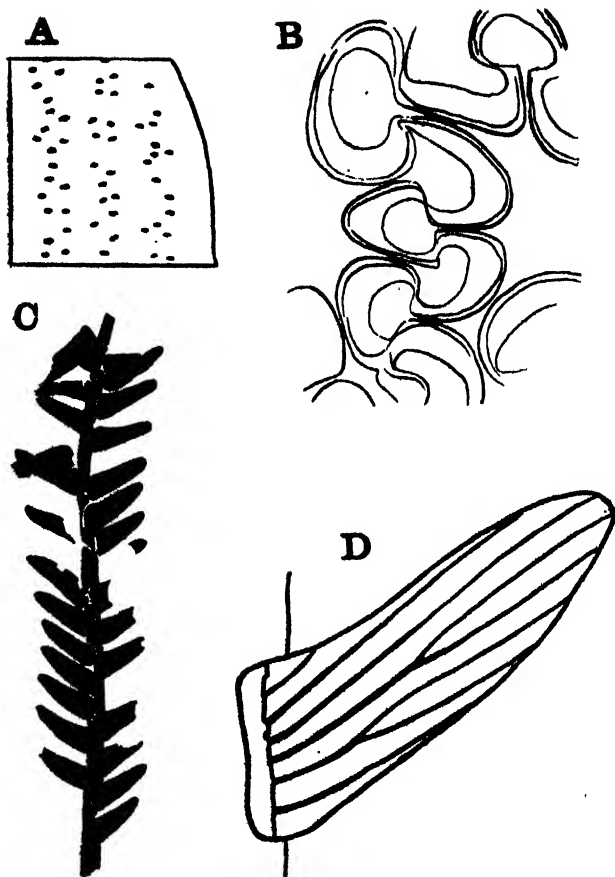
*Description*.—*P. caytonense* is represented by a single specimen which was recognized as the result of the examination of the cuticles of all the available specimens of *Ptilophyllum* in the Wonnacott collection. Its features are indicated in the diagnosis and figures. Although it is broken and rather distorted, the fine details are well-preserved, and it yielded excellent cuticles.

Typical cells of the upper epidermis and a typical stomate are figured at high magnification. The stomates do, indeed, vary somewhat, particularly in the development, of the papillæ which overhang the guard-cells. These may be larger or smaller and differently shaped and more or less hollow. The extent to which the cuticles of the general surface overhangs the poles of the stomates also varies.

*Comparison*.—*P. caytonense* is a member of the species-complex which has been called *Ptilophyllum pecten*. It is a narrower leaf than most members of this group, and it differs too from many in the rounded lower angle of the pinnæ.

It somewhat resembles *P. acutifolium*, as interpreted by Seward and Sahni, 1920, in the form of its pinnæ,

Fig. 1.

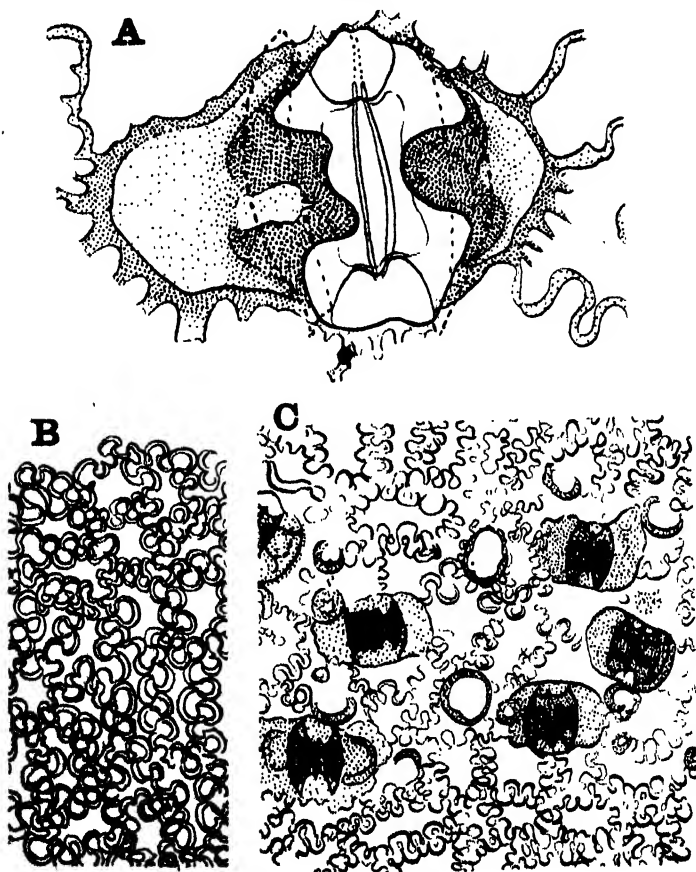
*Pilophyllum caytonense*, sp. n.

- A, piece of lower cuticle, including the pinna-margin, showing the distribution and orientation of stomata (ovals drawn parallel with stomatal aperture),  $\times 20$ . B, upper cuticle, showing details of cell-outlines,  $\times 1000$ . C, type-specimen, natural size. D, one pinna, showing the veins,  $\times 8$ . All from V.26756, Geol. Dept., Brit. Mus. (Nat. Hist.).

but is well distinguished by its less numerous stomates and more sinuous cell-walls.

Its cuticle agrees roughly at least with some of those species of *Ptilophyllum* in which papillæ are feebly

Fig. 2.



*Ptilophyllum caytonense*, sp. n.

A, typical stomate,  $\times 1000$ . B, upper cuticle,  $\times 200$ . C, lower cuticle, stomatal band and cells along a vein (above) and near margin (below),  $\times 200$ . All from V.26756.

developed on the underside, such as the species interpreted as *P. pecten* by Thomas and Bancroft, 1913; .

Seward and Sahni, 1920 ; Florin, 1933 ; and some British Museum specimens labelled *P. pecten* from Whitby (Lower Estuarine age) which I have examined for comparison ; there are, however, slight distinguishing differences between the cuticles of the Whitby specimens at least and *P. caytonense*.

Full comparison with these and similar forms will not at present be attempted, but only with the species *P. gracile*, which is known in such a manner as to make such comparison possible. Though looking rather like *P. gracile* Harris (1941), it is distinguished from it by the following differences :—

(1) The leaf is slightly wider than the widest specimen of *P. gracile* (maximum width 12 mm., normal width 10 mm.).

(2) The pinnae have a rounded, instead of decurrent, basal margin.

(3) The veins are clearly shown by the surface of the pinnae, while the supplementary grooves shown by *P. gracile* are absent.

(4) The lower cuticle is strikingly different ; in *P. gracile* almost every cell except those near the leaf-margin bears a mushroom-shaped papilla, and these papillae are so conspicuous as to conceal the stomata. Here, although the cell-surface bulges somewhat, it rarely does so to such an extent as to form a papilla with a definite margin. The cell-outlines, on the other hand, are far more conspicuous.

This species would have been classified by Halle (1913) as a species of *Zamites* of the section *Subzamites*, because the pinna-base is rounded and not decurrent. While fully sympathizing with Halle's wish to arrange these leaves in better-defined genera than at present, and approving in general of Halle's proposed basis, I have not adopted this course for the following reason. Comparison of Halle's interpretation of the type of *Ptilophyllum* and Seward's interpretation (1917, p. 518) leaves me in complete obscurity as to what the specimen was like, and any attempt at revision of the genera before this is re-examined is to run a risk of increasing the present muddle. The precise description of constituent species of this complex should, however, help to clear the limits of these and other allied genera.

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2. *Deltolepis credipota*, gen. et sp. nov.  
(Figs. 3 & 4.)

*Diagnosis of Deltolepis.*

Scale-leaf of large size, shape broadly triangular; outer surface convex; attachment-scar very wide, situated just above the base on the concave side. Vascular tissue of numerous nearly parallel bundles ending in the margins and apex. Substance thick, but becoming thin towards the margins.

Cuticle well developed; epidermal cell-walls nearly straight, guard-cells of stomates sunken, surrounded by a single irregular ring of subsidiary cells.

The name refers to the triangular shape of this scale-leaf.

*Deltolepis crepidota*, sp. n.

*Type-specimen*, V. 21416 (figs. 3 & 4); Geol. Dept., Brit. Mus. (Nat. Hist.).

*Age*.—Middle Estuarine (Bajocian).

*Locality*.—Cayton Bay, Yorkshire. Collected in 1930 by W. N. Edwards.

*Diagnosis*.—Width of scale-leaf at base typically 15 mm., length typically 18 mm. Apex pointed or mucronate, base straight or somewhat rounded. Both surfaces thickly marked with short longitudinal ridges. Resin-bodies absent.

Cuticle moderately thick; cuticle of convex (i.e. lower) side the thicker, showing frequent stomates in the middle and upper region, but none at the base or lower part of the margins. In upper part of scale cells not in obvious



rows; cell-outlines straight, rather strongly marked, surface of cells obscurely mottled. In lower part of scale cells forming distinct longitudinal rows; lateral walls strongly marked by a fine, inward-pointing lamella of cuticle, the inner margin of which is waved, cell-surface marked by a more or less broad border of slightly thicker cuticle, border occasionally extending to the middle of the cell, but usually leaving an inner mottled area. Stomata scattered, positions not related to vascular supply, subsidiary cells forming a wide and deep-cutinized pit, mouth of pit more or less closed by horizontal papillæ of subsidiary cells. Guard-cells thinly cutinized and wholly immersed. Trichomes frequent in the upper part of the scale-leaf, each consisting of a thick-walled but uncutinized hair over  $200\mu$  long,  $30\text{--}40\mu$  broad, borne on a rounded cutinized cell with margins extending over cuticles of the ordinary epidermal cells. Concave side with neither stomates nor trichomes, cell-outlines obscurely marked in the upper part, more distinct below, but never as distinct as on the convex side. Cells isodiametric, polygonal, surface mottled. Cell-outlines often appearing double (*i. e.* with a medial thin strip flanked by thicker bands).

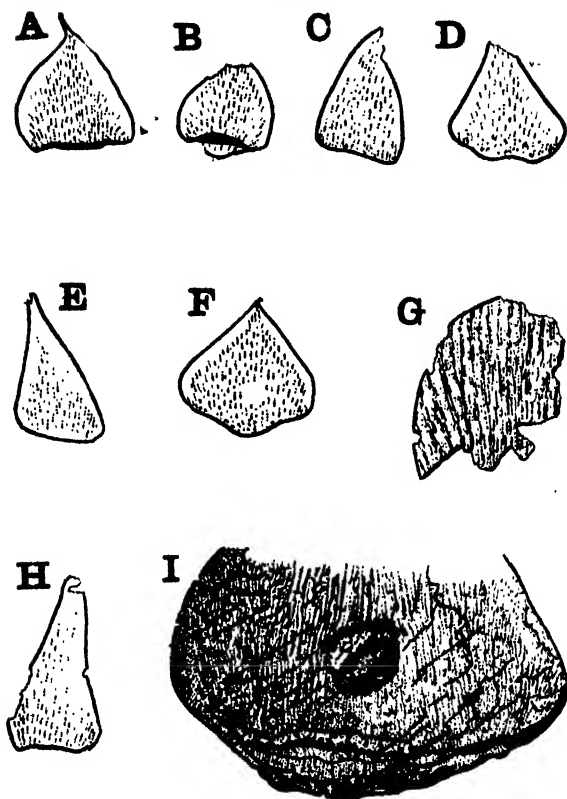
The specific name refers to the characteristic thickened margin of the epidermal cells.

*Description.*—*D. crepidota* is represented by fourteen specimens. It is thus fairly frequent in the Edwards and the Wonnacott collections, and although it seems far less abundant than some species, such as *Nilesonia compta*, the apparent abundance of that leaf is greatly increased by the fact that it breaks up to give many fragments which are recognizable. The two fossils may indeed be equally common.

It will be seen from the figures that the shape and dimensions of *D. crepidota* vary somewhat: the figures cover the range of form represented in this collection, apart from a few which have been crushed laterally and so appear narrower. In nearly all it is the convex surface that is exposed, and in breaking the rock the epidermal hairs are mostly stripped off.

The scar of attachment is best seen in transfer-preparations. It is remarkably wide, and its surface is marked with small lumps of bituminous matter which

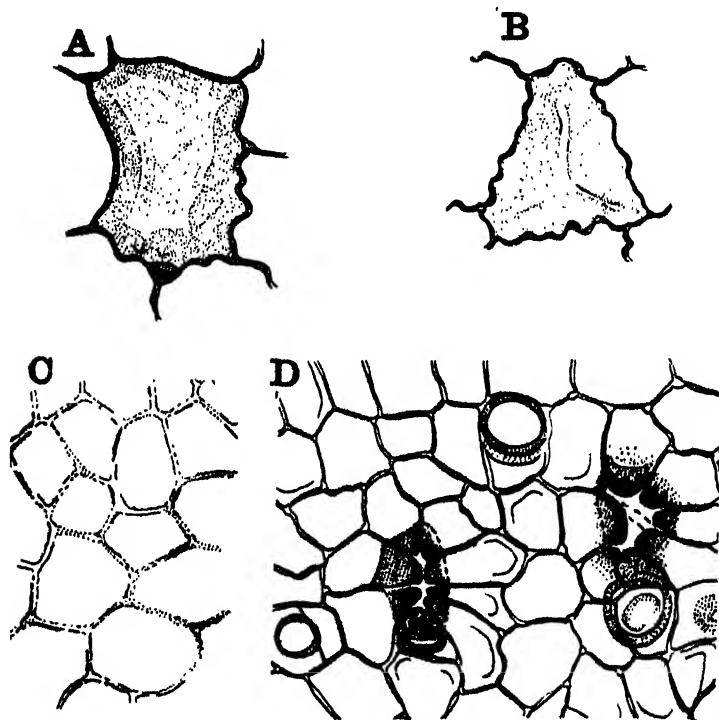
Fig. 3.

*Delsolepis crepidota*, sp. n.

In A-F and H, which are natural size, the stippling merely represents the direction of the surface ridges; individual ridges are not shown. Individual ridges are shown to some extent in G, and more distinctly in I. A, V.23935. B, V.25839, showing concave surface and attachment scar. C, V.23952. D, V.21417. E, V.21418. F, type-specimen, V.21416. G, V.24681, fragment showing veins,  $\times 2$ . H, V.24706. I, transfer of F, type-specimen, showing the concave surface and attachment-scar; the round body in the middle is a pyrites concretion which has nothing to do with the original specimen, V.21416,  $\times 3$ .

are thought to represent isolated sclerotic cells like those in the flesh of the seed of *Beania* (and in many recent Cycad seeds). The arrangement of these lumps suggests that there may have been a row of several vascular bundles, but these were not seen distinctly.

Fig. 4.



*Deltolepis crepidota*, sp. n., cuticle.

- A, bordered epidermal cell from near lower angle (convex surface), type-specimen, V.21416,  $\times 800$ . B, broadly bordered epidermal cell from lower part of scale-leaf (convex surface), V.26834,  $\times 800$ . C, cells from near apex of scale (concave surface), V.21416,  $\times 400$ . D, cells of convex side, opposite the part shown in C, V.21416,  $\times 400$ .

Both surfaces are thickly covered with longer or shorter longitudinal ridges, which are, however, absent from the thin marginal and apical parts. These ridges are unrepresented in the cuticle, and it is thought that they

were produced in compression by the collapse of soft tissues, leaving sclerotic cells as ridges projecting on both surfaces. They are different from the wrinkles produced by lateral distortion in compression of various fleshy fossils (such as the similar-looking scale *Cycadolepis*); such distortion wrinkles are usually more or less transverse and are far less definite than the ridges referred to here. As a matter of fact a few wrinkles of this type occur in certain specimens of *Deltolepis*.

The veins are not shown by most specimens of *D. crepidota*, but in one in which the substance is thin, and seems to have become naturally macerated before preservation, the grouping of the surface-ridges almost certainly shows their course. These veins seem to be parallel in the main; they branch, but do not anastomose. (Fig. 3, G).

In its middle and lower part the coaly substance of the scale is rather thick, but towards the margins and apex it becomes thinner and even slightly translucent. Its substance, particularly where it is thickest, is remarkably fragile, a fact which increases the difficulty of preparing the cuticle, a point of agreement with the other organs of this plant. The cuticle of every specimen was, however, examined and although some gave very poor preparations, all the good ones agree well with the diagnosis.

The shape and the concavo-convex surface of *Deltolepis* suggest a bud-scale, or perhaps a sepal-like scale. The distinctly greater thickness of the cuticle of the convex side (which is morphologically the lower), and the restriction of the stomata to the middle and upper parts of this surface, are important points of agreement with the scale-leaves of buds, where these features are normal.

*Reference to the same plant as Androlepis and Beania.*

In a previous paper Harris (1941) brought forward evidence that *A. manis* and *B. gracilis* were the male and female organs of the same plant. The evidence depended on various peculiarities of the cuticle; the general build of the stomates shows what may be termed family, or perhaps generic, agreement, while the epidermal cells of the exposed scales and details of the stomates show specific agreement.

The cuticle of *D. crepidota* agrees very perfectly with both of those fossils, and every word that was given in support of the argument that the two fossils previously described belong to the same plant can be applied directly to the present fossil. It need not therefore be repeated. The reasons for referring *Nilssonina compta* to the same plant are given in the following paper.

*Comparison.*—*Deltolepis crepidota* is distinguished by its shape from all of the fairly numerous Mesozoic scale-leaves which have been described; nor is any scale-leaf known with a similar cuticle. Most scale-leaves, if named at all, have been described as species of *Cycadolepis* Saporta, a genus first used for narrow lanceolate scales, but later extended by Seward (1917, p. 494) to large scale-leaves of varied shape among which the present species would be by no means extreme. Specimens closely resembling Saporta's type have been shown to be outer perianth-bracts of Bennettitalean flowers or to have Bennettitalean stomates, and it appears best to limit the form-genus *Cycadolepis* to lanceolate bracts, with stomata of Bennettitalean type.

Another genus of scale-leaves is *Cloughtonia* Halle (1911), which is represented by a single species of large scales well distinguished from *Deltolepis* by their spatulate shape and more conspicuous veins. The stomates and systematic position of *Cloughtonia* are unknown.

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#### 3. On *Nilssonina compta* and its reference to *Beania gracilis*.

*Nilssonina compta* (Phillips) Bronn is a very common leaf in the Yorkshire Jurassic flora, and fine specimens have been figured by Seward (1900) and by other authors whom he cites. A brief account of the cuticle is given by Thomas and Bancroft (1913). Fragments of *N.*

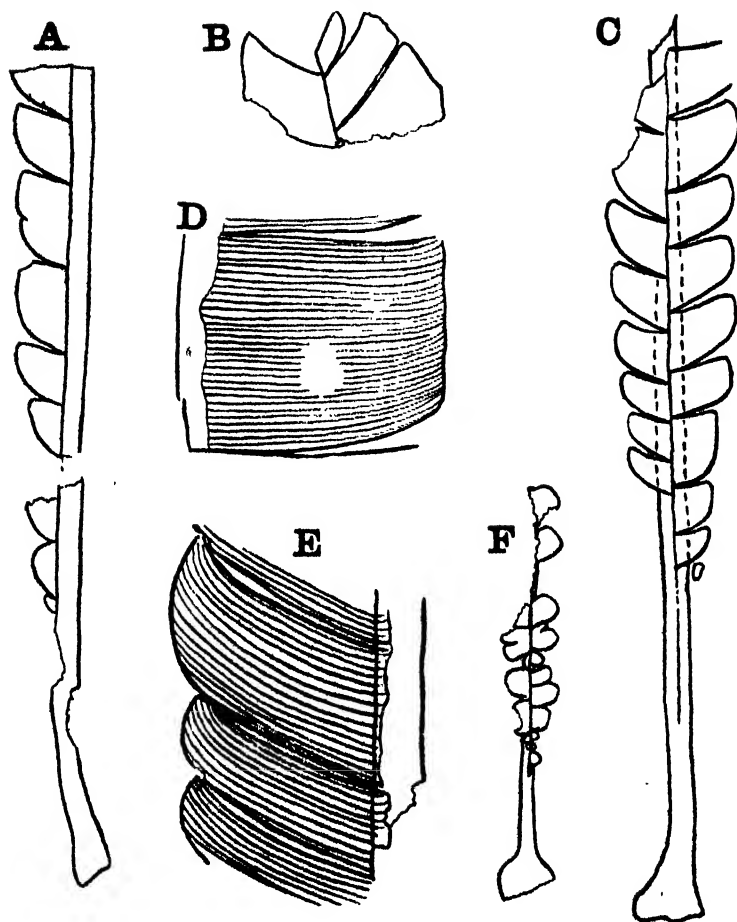
*compta* abound in the Edwards and the Wonnaoott collections from the Middle Estuarine plant-bed of Cayton Bay, on which the present account is based. It is re-described here partly to give the evidence that it belongs to the same plant as *Beania gracilis*, and partly to provide the characters needed to distinguish it clearly from certain other species.

*Form.*—The leaf is linear-oblongate in outline, being many times longer than wide, the apex obtuse and the base tapering. Typical leaves are 3 or 4 cm. at the widest point, very few leaves exceed 6 cm.; the length is estimated at between 50 and 100 cm. This figure was obtained by dividing the total length of all available fragments by the number of leaf-bases present. The lamina is divided into segments which vary from being as long as broad to three times as long as broad; in some leaves they are mostly long, in some mostly broad, in some mixed. The specimens figured in fig. 5 D, E cover almost the whole range of variation of segments seen in this species, apart from rare malformations and the triangular segments of the leaf-base.

*Venation.*—The veins make conspicuous ridges on the lower side of the lamina, but are only shown obscurely above as slight ridges, furrows, or double ridges separated by a furrow. Over most of the lamina they make an angle of  $70^{\circ}$  to  $80^{\circ}$  to the rachis; near the margin they bend forwards, while at the very base they appear to be almost transverse to the rachis. They traverse the lamina at a concentration of about 20 per cm. (highest concentration noted 26, lowest 14 per cm.). Their concentration seems fairly uniform in each specimen, and differences in concentration are unrelated to differences in shape of the leaf-segments. As in other species, branching is very rare; one of the few forked veins seen is shown in fig. 5 E.

The substance of the lamina is fairly thick but fragile, as is usual in this genus. No folds occur in the lamina, and there are no interstitial ducts or tubercles between the veins, and on maceration no definite resin-bodies are obtained, although there may be a quantity of ill-preserved cellular matter. The epidermal cells are scarcely prominent on the upper side, but below their projecting walls are easily seen, and the distinction between rows of rectangular cells along the veins and the irregular

Fig. 5.

*Nilssonia compta* (Phillips).

A, lower part and base of leaf, V.21408,  $\times 1$ . B, apex of leaf, V.21410,  $\times 1$ . C, lower part and base of leaf, V.21413,  $\times 1$ . D, square type of leaf-segment, showing veins, V.25828,  $\times 2$ . E, elongated type of leaf-segment, showing veins; the lowest of those drawn is forked, V.21410,  $\times 2$ . F, basal part of small leaf, with abnormal lamina and leaf-base, see p. 529, V.25867,  $\times 1$ .

ones between is obvious. The stomata are not conspicuous and the trichomes are not, as a rule, seen at all.

*Cuticle*.—The cuticle is rather thin and fragile, the under being slightly less than  $1\mu$ , the upper about  $1.5\mu$  thick; it is only possible to obtain useful preparations from the most favourable specimens. It is, however, thicker than in many other species of *Nilssonia*. The upper shows almost uniform cells which are slightly longer than broad. The course of the veins is usually unmarked, but sometimes obscurely indicated by compression wrinkles or a slight narrowing of the cells. The cell-outlines are remarkably inconspicuous, sometimes being indicated by a single rather broad ridge, sometimes by two narrow ridges separated by a thin strip. Occasionally these ridges are uneven, giving a suggestion of sinuosity. The cell-surface is very obscurely mottled. No stomates occur here, and trichomes are rare except near the margins.

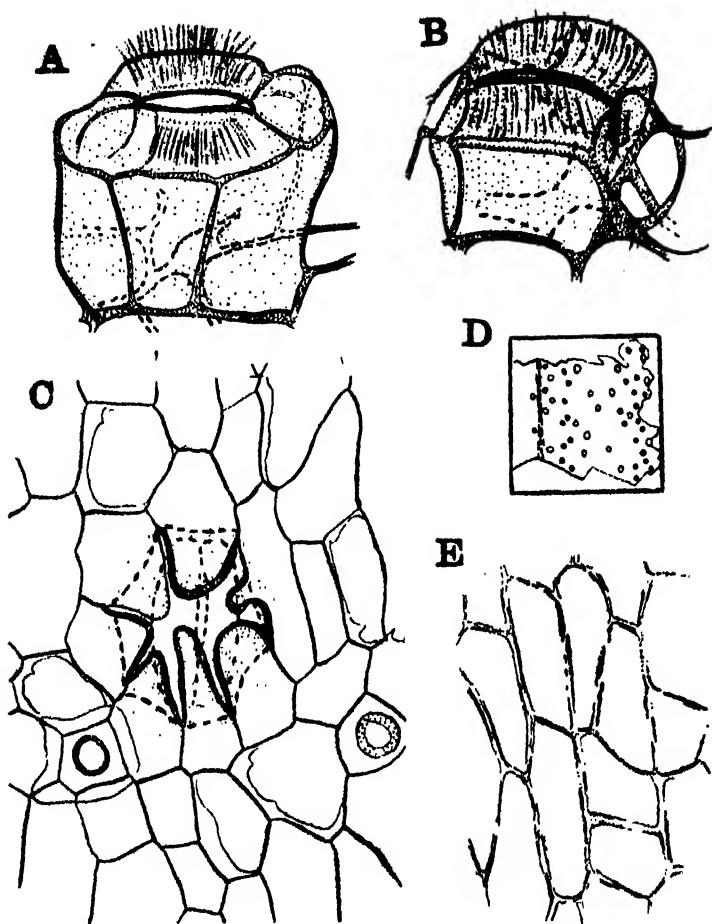
The lower cuticle is divided into zones, those along the veins without stomates, those between them with the stomates. The widths of the two zones may be more or less equal, or the stomatal zones may be the narrower. The epidermal cells are very different from those of the upper side, as their cuticles project inwards along the margins as a lamella  $1-5\mu$  high, or even more at corners of cells. This obscures the details of cell-outlines, particularly those of the stomatal zones, and makes them look rounded. The cell-surface is mottled.

Trichome bases are frequent along the veins and leaf-margins. Each consists of a small-thickly cutinized oval cell bearing a ring-shaped scar. The outlines of the ordinary epidermal cells can often be traced underneath the trichome base. The free parts of the trichomes in *Nilssonia* have not been described; examination of transfers shows that they are often missing from the lamina, but numbers are commonly present along the rachis, where they can easily be seen when the rock-impression is moistened with xylol. Each consists of a straight or curved hair of slightly tapering shape and with fairly thick walls. It is apparently a single cell and is uncutinized. The longest seen on a rachis was  $500\mu$ , but those on the lamina are about  $300\mu$ .

The stomates are rather sparsely scattered along the grooves between the veins. The guard-cells are situated



Fig. 6.



*Nilssononia compta* (Phillips) cuticle.

A, distorted stomatal pit from the inside; the guard-cell fibrils are separate from the main cutinized layer,  $\times 800$ . B, similar stomatal pit; the arched surface of the guard-cells is seen. In A and B the papillae are shown by broken lines. C, stomata and trichome bases from the outside; the stomatal pit and guard-cells are represented by broken lines,  $\times 400$ . D, fragment of cuticle, upper surface to the right; stomata represented by black dots, trichomes by open circles; the square is 1 mm.,  $\times 20$ . E, upper cuticle,  $\times 400$ . All from V.26835.

at the bottom of a pit which is both wide and deep. There are 6-8 subsidiary cells forming an irregular ring. At the margins of the pit the cuticles of the subsidiary cells project inwards as very long, hollow papillæ; these papillæ often meet in the middle or even cross the middle of the pit, so that the aperture is irregularly star-shaped. The cuticle of the papillæ seems to be only slightly thicker than the general surface, and, as far as was made out, the papillæ do not project outwards to any extent.

The pit is lined by a moderately thick cuticle which, with the cuticle of the guard-cells, forms a tent-like projection in the leaf. This lining is the most conspicuous part of the stomate, and appears to be the "chimney-like" structure mentioned in the account given by Thomas and Bancroft (1913), but it projects inwards, not outwards. The margins of this pit are divided into a number of facets corresponding to cells; but it was not clear whether these facets correspond in number and position with the papilla-bearing cells surrounding the stomatal pit.

The surface of the guard-cells is strongly curved, the aperture being much deeper than the poles. At the sides of the aperture fine fibrils extend laterally for some distance, their outer ends being unconnected to the main cuticle of the surface. The nature of these fibrils is unknown, but the way in which they are curved and their position of attachment indicate that they belong to the outer wall of the guard-cells.

*Comparison.*—*N. compta* resembles the following species in its general appearance, but is distinguishable from all by the microscopic features given above:—

*N. polymorpha* Schenk (see Nathorst, 1909; Florin, 1920) is distinguished by the occurrence of broader stomatal bands. The stomatal pit is much shallower, and the surrounding papillæ point outwards.

*N. acuminata* (Presl); see Gothan, 1914. Gothan has already compared this species with *N. compta*, basing his account partly on a rather imperfectly preserved specimen of *N. compta* cuticle from Yorkshire. It is now clear that *N. acuminata* differs in possessing large resin-bodies in the lamina and stomatal zones much broader than the vein-zones. The cells of the upper epidermis are better defined, but the details of the stomates are not known.

*N. minor* Harris (1932). The stomates are much more exposed, and the papillæ of the subsidiary cells are scarcely developed.

*N. tenuicaulis* (Phillips), which it is hoped to discuss in a later paper, is distinguished readily by its cuticle, and most specimens are fairly easily differentiated on their general form.

There are a number of other descriptions of similar *Nilssonia* leaves, some of them referred to *N. compta*, from various localities, but as their microscopic details are unknown no comparison is attempted here.

*The Reference of Nilssonia compta to the same  
Plant as Beania gracilis.*

In an earlier paper (Harris, 1941) evidence was brought forward indicating, firstly, that *Beania gracilis* and *Androstrobus manis* were the female and male cones of the same species, and secondly, that the fruit-genus *Beania* belonged to plants bearing leaves of the genus *Nilssonia*. In the preceding note the scale-leaf *Deltolepis crepidota* is linked with these reproductive organs; it remains to consider the species of *Nilssonia* concerned. The following evidence indicates that this is *Nilssonia compta* :—

(1) *Agreement in Structure*.—There is close resemblance between the cuticle of the upper, more leaf-like portion of *Deltolepis crepidota* and the lamina of *N. compta*. This is shown both by the upper cuticle (where the epidermal cells show similar sculpture and similar, rather indistinct outlines, which often appear double) and by the lower cuticle, where the epidermal cells show remarkably prominent anticlinal walls in both. The stomata are very similar indeed, except that they are larger in the leaf. The resemblance between *N. compta* and the cuticles of the sporophylls is less close, though, as has been mentioned, the lower, less leaf-like portion of the *Deltolepis* scale shows almost perfect agreement. In this way *Deltolepis* provides a valuable link between the rather different cuticles of the leaf and sporophylls. The cuticles of the two other *Nilssonia* species of the Gristhorpe plant bed, *N. tenuinervis* and *N. tenuicaulis*, have not been adequately described, and it is hoped to deal with them in subsequent notes; but it may be stated that

while their cuticles show the usual generic characters of *Nilssonia*, they have no features suggesting specific agreement with the organs discussed above. In both the stomatal pit is much less developed.

(2) *Occurrence of Specimens of Intermediate Structure between Nilssonia and Deltolepis.*—The small *Nilssonia* leaf shown in fig. 5 F has an irregular lamina which is proved by its cuticle to belong to *N. compta*, a slender petiole and, considering the small size of the whole specimen, a leaf-base that is remarkably broad. The full size of the leaf-base of this specimen is, indeed, unknown, as the base has been damaged. This leaf-base is more like *Deltolepis crepidota* than an ordinary *Nilssonia compta* leaf-base, its substance is thinner, particularly near the margins, and the surface is marked with the same short longitudinal ridges that characterize *Deltolepis*.

The cuticle of the base of this leaf is well developed. In the middle it is rather like an ordinary *N. compta* leaf-base: one side is greatly thickened and shows short cells with very broad but irregular and ill-defined lateral walls; the other is moderately thick, showing cells with clearly defined outlines and a few trichome bases. The margins are like those of *Deltolepis crepidota*; neither side is thick, the one shows angular epidermal cells with fairly conspicuous outlines, the other shows similar cells with even more strongly marked outlines and also trichomes, and, in addition, many of the cells show a sculptured wall consisting of a broad, thickened border to the lateral walls, enclosing an inner mottled area. The lateral walls project inwards as a fine cutinized lamella, the free margin of which is sometimes waved. This agrees with the characteristic epidermal cells of *Deltolepis*; similar ones occur in certain regions of the sporophyll of *Beania gracilis* and *Androstrobus manis*, but not, so far as is known, in normal leaves of *N. compta*.

This specimen is regarded as being of the same nature as the organs intermediate between bud-scales and foliage-leaves which are occasionally met at the beginning of a year's growth in various trees. It could equally well have been described under the name *Deltolepis*.

*Association.*—So far as is known there are only three species of *Nilssonia* in the plant-bed; indeed, this is all that have been described from Yorkshire, though Thomas

and Bancroft (1913) indicate the existence of others in other localities. Of these three, *N. compta* occurs on every rock-specimen of any size that bears one of the other organs, *N. tenuinervis* is frequently associated, *N. tenuicaulis* is rare in this collection and has never been found associated. These facts of association, while fully consistent with the view put forward, are only considered to provide evidence of subsidiary importance.

*Reconstruction of the Plant bearing Nilssonia,  
Deltolepis, Beania and Androstrobus.*

We now know several organs of the whole plant, but not, unfortunately, the stem. No attempt is therefore made to draw its appearance, as there seem too many possibilities. A clue to the appearance of the stem is, however, provided by the foliage and scale-leaves. The size and curvature of the scale-leaves indicate a thick stem, perhaps 3 cm. wide, and this stem would show the scars of the right size for *Nilssonia* leaves, and then at intervals wider and perhaps more crowded scars corresponding to *Deltolepis* scales. No such stem is known in the Yorkshire flora, where stem-material has been largely neglected. Such a stem is, however, known from an earlier flora (where *Nilssonia* spp. occur), namely, *Clathraria saportana* Nathorst (1879, p. 78, pl. xviii. fig. 5). It would be most interesting to know whether *C. saportana* has any features in its outsole which would support the suggestion that it may belong to *Nilssonia*.

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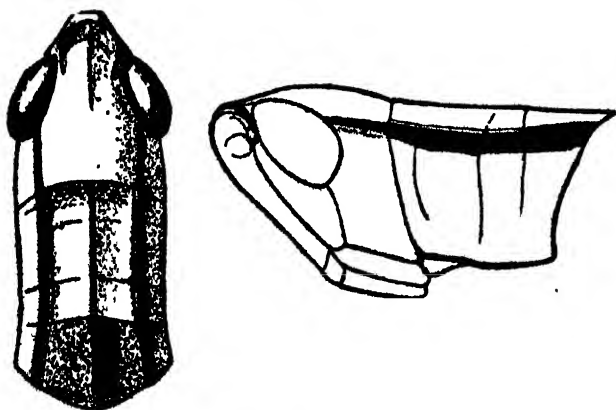
XLVII.—*New Acrididæ from India and Burma.* By B. P. UVAROV, D.Sc., British Museum (Natural History).

THE types of the new species described below have been deposited in the British Museum collection, unless stated otherwise.

*Orthochtha indica*, sp. n. (Fig. 1.)

The genus *Orthochtha* Karsch and the closely-allied *Cymochtha* Karsch and *Macrocymochtha* Sjöstedt include a number of species, all of them known to occur in tropical

Fig. 1



*Orthochtha indica*, sp. n., ♂.

grasslands of Africa. The present species is, therefore, the first to be reported from India, and it is abundantly different from the known ones. Indeed, its relatively

stout habits and short head suggest that it might be regarded as representing a distinct genus, but the African genera of the group are insufficiently studied and it would be unwise to erect a new genus without a critical revision of the whole group.

♂.—Antennæ very long and slender, extending back beyond the base of hind femur; joints 3–6 flattened and weakly expanded, 7th weakly flattened, the remaining ones round and 3–4 times as long as broad.

Head distinctly shorter than pronotum. Face less oblique than in the genotype, *O. dasyncnemis* (Gerstaecker, 1869), smooth. Frontal ridge broadly sulcate throughout, except close to the fastigium. Fastigium of vertex scarcely longer than wide, weakly concave, with a shallow bow-shaped sulcus and a weak longitudinal carinula. Eye, viewed in profile, shorter and broader than in the genotype.

Pronotum long, laterally compressed. Disc practically flat, slightly rounded transversely in prozona, and very weakly tectiform in metazona; rugulose near the front margin and fairly densely punctured in metazona. All three carinæ low, but distinct; lateral carinæ practically straight and parallel in prozona and very weakly divergent in metazona. First sulcus incomplete on the disc; second not reaching the median carina, but extending on to the lateral lobes; third complete, placed at about two-thirds of the whole length. Front margin broadly rounded; hind margin rounded. Lateral lobe much longer than high; lower margin very slightly sinuate.

Mesosternal interspace narrow, constricted in the middle. Metasternal lobes almost contiguous behind.

Elytra reaching a little beyond hind knees, wider than in the genotype; venation loose.

Last tergite with broad parabolic excision. Supra-anal plate tongue-shaped, with broad median depression. Cercus as long as the plate, slightly compressed and weakly incurved. Subgenital plate short, obtusely-conical.

General coloration very light yellowish green. Antennæ blackish, except the base. A brownish-black lateral fascia runs along the sides of fastigium, behind the eyes, along the upper margin of lateral pronotal lobes and along the basal third of the radial veins. Elytra light green in the pre-radial part, and slightly brownish in the

post-radial. Hind knee broadly blackened, but the upper carinae brown. Hind tibia light rose, with the base black ; hind tarsus rose.

♀.—Antennae a little longer than head and pronotum. Fastigium of vertex transverse. Hind knees brown.

Total length, ♂ 31, ♀ 42 ; pronotum, ♂ 6.5, ♀ 8 ; elytra, ♂ 27, ♀ 32 ; hind femur, ♂ 19, ♀ 22 mm.

UNITED PROVINCES : Delhi, viii. 37, 2 ♂♂ (including the type), 2 ♀♀, at light (Kerr).

CENTRAL PROVINCES : Nagpur, 8. vii. 1927, 1 ♀ ; 20. viii. 1927, 1 ♀ (J. L. Khare).

Paratypes will be deposited in the Agricultural Research Institute, New Delhi.

*Edaleus roscens*, sp. n.

There is, so far, only one known species of this genus with red hind wings, this being *O. miniatus*, Uvarov, 1930 (Ann. & Mag. Nat. Hist. ser. 10, vi. p. 177), of British Somaliland, and the new Indian species differs strongly from it in the fully-developed elytra, fasciated hind wings and the structure of pronotum.

♂.—Antennae longer than head and pronotum together. Face oblique, punctured. Frontal ridge well prominent, forming a rounded angle with the vertex ; surface deeply sulcate from the base of antennae downwards. Fastigium of vertex much longer than wide, distinctly narrowed forwards, slightly concave ; foveolae flat, short isosceles triangles.

Pronotum rugulose, relatively short ; anterior margin very obtusely angulate ; posterior angle a little over 90°. Median carina weakly convex in profile, strongly inflated in prozona and in the anterior portion of metazona, which is obliquely depressed on each side of the carina. Typical sulcus scarcely perceptible on the sides of the carina, placed immediately behind the middle. Lateral lobe with the lower margin weakly sinuate.

Elytra reaching the middle of hind tibiae, relatively narrow.

Hind femur relatively short, wide in the basal half, then rather suddenly narrowed. Tarsal arolia shorter than half the claw.

Coloration mostly ochreous brown. Head with whitish postocular fasciae. Pronotum with the usual dark pattern



weakly developed and the white decussate pattern scarcely perceptible. Elytra brown, with the usual whitish fasciae. Wing disc very pale cinnabar-red; brown fascia weak, imperfectly defined, interrupted, touching outer margin; apical portion of wing hyaline; two apical lobes brown.

♀.—More robust than the male. Fastigium of vertex less than half as long again as its basal width. Pronotum more distinctly rugulose; median carina less inflated. General coloration dull greyish ochraceous; pronotal light pattern more distinct. Wings very pale reddish at the base (probably discoloured); one apical lobe infumate. Hind tibia pale dirty reddish (probably discoloured).

Total length, ♂ 17, ♀ 24; pronotum ♂ 4.5, ♀ 5.2; elytra, ♂ 19, ♀ 21; hind femur, ♂ 11, ♀ 13 mm.

RAJPUTANA: Nokh. l. viii. 1937, 1 ♂ (*type*).

PUNJAB: Khewra, Salt Range, 24. ix.-x. 30, 1 ♀ (*S. L. Hora* and *H. S. Pruthi*).

The female paratype belongs to the Indian Museum, Calcutta.

#### GRAMMOSCAPHA, gen. nov.

A medium-sized, slender insect, similar in habitus to *Morphacris* and related to *Gastrimargus*, but remarkable for its very broad and tri-lineate fastigium, straight and sharp pronotal carina, and the pronotal disc very acutely produced both in front and behind.

Antennae filiform, relatively short. Head not thick, but vertex very broad, convex and provided by a well distinct median carinula, which commences on the frontal ridge just above the base of antennae and becomes obsolescent on the occiput; on the frontal ridge and on the fastigium of vertex there are two more parallel raised lines, which are, however, lower and somewhat less regular than the medium ridge. Frontal ridge, viewed in profile, is decidedly convex and forms a broad bow with the vertex; above the antennae it is weakly convex in the transverse direction, becoming almost flat and gradually obsolescent towards the clypeus; its margins are scarcely raised, but quite distinct throughout. Lateral facial carinae well distinct, weakly curved. Foveolae of vertex on oblique plane, not concave, weakly rugulose; their

upper margin distinct, the lower less regular and more curved. Eye vertical, oval; horizontal diameter equal to subocular distance. Pronotum laterally compressed and constricted in prozona; above tectiform, with acute, lamellate median carina, which is straight in profile and not intersected by any of the sulci; front margin forming an acute angle; hind margin produced into a long and very acute angle, with its sides somewhat concave; no definite lateral carinae, but the shoulders in metazona somewhat roundly prominent; all transverse sulci weak, the typical one just reaching the median carina behind its middle but not cutting it. Mesosternal lobes strongly transverse, with the inner margins broadly rounded and divergent, widely separated; metasternal interspace transverse. Tympanum  $\frac{3}{4}$  open, deep. External genitalia ordinary. Front and middle femora compressed, carinulate; hind femur slender, its upper carina acute, not serrulate; tarsal arolia nearly half as long as claws. Elytra narrow, with the apex obliquely rounded-truncate; apical half hyaline, with regular elongate cells; basal half subhyaline, with thick irregular reticulation; false discoidal vein nearer to the ulnar than to the radial in the middle, but broadly curving forward in the apical portion; cells both in front and behind the false vein in the discoidal area are irregular, small, about 3-4 deep; interulnar area at its widest a little broader than the discoidal, its reticulation less dense; furcal area fairly regular, moderately broad, its reticulation as dense as in the interulnar area.

Genotype: *Grammoscapha burmana*, sp. n.

*Grammoscapha burmana*, sp. n. (Fig. 2.)

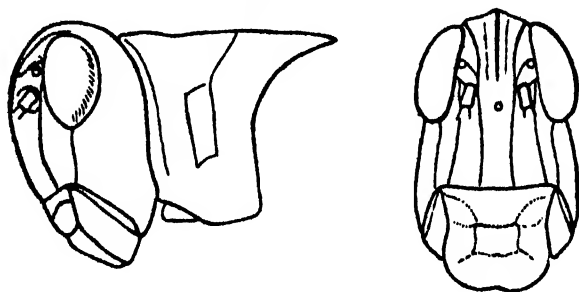
♂.—Antennae shorter than head and pronotum, slightly incrassate apically. Head and pronotum with low, callous rugosities and shallow punctures. General coloration uniformly light ochreous-buff; elytra with a faint suggestion of two whitish fasciae; wings very light blue in the basal two-thirds, hyaline and brown-veined apically, with faintly indicated pale-brownish triangular spot at the middle of the outer margin, apparently corresponding to the posterior end of an almost completely obsolete wide fascia; hind femur on the inner side brownish, with a lighter apical ring and brownish knee; hind tibia brownish grey.

Total length 19 ; pronotum 5 ; elytra 21 ; hind femur 14 mm.

LOWER BURMA : Prome, on grass, 18. ii. 1918, 1 ♂.

It is not improbable that the only type is a very pale specimen, and that in the darker ones there will be more

Fig. 2.



*Grammoscapha burinana*, gen. et sp. n., ♂.

pronounced elytral pattern, as well as a distinct wing fascia. The latter may be expected to be rather wide and perhaps even to occupy the whole apical half of the wing.

#### ASSAMACRIS, gen. nov.

A medium-sized Catantopine of uncertain affinities ; possibly an aberrant member of the Catantopini in the narrow sense.

Antennæ slender, probably very long (incomplete in the type and the paratype).

Face foveolate, strongly oblique ; frontal ridge in profile roundly prominent between antennæ, weakly concave below them ; its margins somewhat raised in the upper portion, obsolescent below the ocellus ; its surface punctured ; lateral facial carinæ practically straight, weak in the male, obsolescent except near the clypeus in the female. Fastigium of vertex prominent forwards, almost horizontal in male, weakly sloping in female ; separated from the frontal ridge ; lacking median carinula ; margins slightly raised ; surface punctured. Interocular distance narrow, in male not wider, in female a little wider, than the frontal ridge between antennæ. Occiput rounded, with a faintly indicated median carinula. Pronotum

relatively long, cylindrical, somewhat compressed laterally, weakly widened behind; surface foveolate; median carina very low, irregular; no lateral carinae; anterior margin rounded, with a shallow median notch; posterior margin rounded, all sulci distinct, but not deep, the typical one being well behind the middle. Lateral pronotal lobe much longer than high, with the lower margin bisinuate. Prosternal tubercle in the shape of a low swelling, bearing an acute, but not long, conical spine. Mesosternal lobes transverse even in the male; their interspace constricted in the middle and narrower than a lobe even in the female. Metasternal lobes distant in both sexes. Elytra not reaching the end of the abdomen, of leathery texture in the basal part.

Anterior and median femora in the male somewhat swollen; hind femur slender, with the upper carina weakly serrate, and ending in a short spinule, hind knee-lobe truncate behind, its angle being a little under  $90^\circ$ . Hind tibia with nine short spines and without an apical spine on the outer side; with eight longer spines and an apical one on the inner side. Hind tarsus with the first and the third joint elongated; arolia large. Last tergite in the male with a weakly-developed furcula; supra-anal plate broadly tongue-shaped; with a weak median sulcus and a pair of sublateral tubercles; cercus long, sinuate, with a tendency to bifurcation; subgenital plate normal. Valvæ of the ovipositor weak and slender, especially the lower ones, without teeth or serration. Coloration olivaceous brown, with peculiar striped light pattern.

Genotype: *Assamacris striata*, sp. n.

*Assamacris striata*, sp. n. (Fig. 3.)

♂.—Face and lower part of cheeks with dense and large but not deep foveolæ. Fastigium of vertex pear-shaped, longer than wide, its surface slightly concave, rugulose; margins weakly raised, smooth. Occiput with scattered small punctures and a weak median carinula.

Surface of pronotum with dense, large but not deep foveolæ forming a honey-combed pattern.

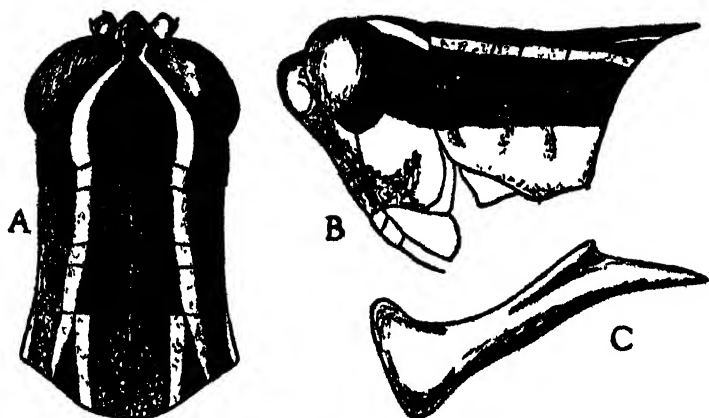
Elytra reaching 8th tergite, with parabolic apex.

Last tergite with a shallow rounded median emargination flanked by small projections. Supra-anal plate with a shallow and broad median sulcus, interrupted in the

middle; at the middle of the lateral margin there is a small and low rounded tubercle. Cercus (fig. 3, C) long, directed obliquely upwards, weakly bi-sinuate, almost bi-furcate apically, but the upper branch represented only by a subacute tubercle, while the lower is long, conical and weakly decurved. Subgenital plate short, viewed from below appears as an equilateral triangle with pointed apex.

Coloration olivaceous brown. Sides and the middle of fastigium, flask-shaped spot on the occiput and post-

Fig. 3.

*Assamaoris striata*, gen. et sp. n., ♂

ocular fascia of the head are black, or blackish brown. Pronotum above and laterally down to the middle of the lobes is dark brown, with sharp pale yellow divergent lateral stripes, which are bi-furcate in metazona. Elytra brown, with pale buff anal stripes. Abdomen with lateral series of black spots of various shapes. Hind femur light olivaceous yellow, with two rather broad brown, black-margined, fasciae of irregular outline; knee brownish. Hind tibia light olivaceous yellow, somewhat blackened at the base, in the middle third and at the apex; all spines shiny black.

♀.—Face less oblique than in the male. Coloration of a lighter shade of brown, so that the light pattern becomes less sharply outlined.

Total length, ♂ 26, ♀ 34; pronotum, ♂ 6.5, ♀ 8; elytra, ♂ 13, ♀ 18; hind femur, ♂ 16, ♀ 19 mm.

ASSAM: Cherrapunji, 4400 ft., 2-3. x. 1914, 1 ♂, *type* (S. W. Kemp; Indian Museum).

BURMA: Mishmi Hills, Theriolang to Pange, 1935, 1 ♀ (*M. Steele*; British Museum).

*Peripolus nepalensis*, sp. n.

Closely related to the only known species, *P. pedarius* (Stål, 1878), differing from it in the following characters:—

Very much smaller and of rather uniform brown coloration; covered with longer and denser hairs; antennæ shorter, the length of the individual middle joints being 2-2.5 times their length (about 4 times in *P. pedarius*); pronotum less tectiform above, the disc less widened behind, with the posterior margin practically truncate (distinctly obtusangulate in *P. pedarius*); elytra relatively broader; hind femur relatively shorter and broader, with stronger denticles on the upper carina.

Comparative measurements  
of *P. pedarius* and *P. nepalensis*.

	Males.		Females.	
	<i>pedarius.</i>	<i>nepalensis.</i>	<i>pedarius.</i>	<i>nepalensis.</i>
Total length . . . . .	32	23	47	31
Pronotum . . . . .	9	5	12.5	9
Elytra . . . . .	6	4.2	9	7
Hind femur, length . . . . .	19	13	27	18
Hind femur, max. width . . . . .	5.5	4	7	5

NEPAL: Nagarkot, 6700 ft., 8. vii. 1937, 7 ♂♂, including the type, 1 ♀, 1 ♀ nymph; ditto, 7000 ft., 25. vii. 1937, 1 ♂, 1 ♀, in copula (*F. M. Bailey*).

*P. pedarius* is known to me from Sikkim and the Darjeeling district, and *P. nepalensis* might be regarded

as its diminutive, dark and hairy subspecies of higher altitudes, were it not for the appreciable difference in the shape of pronotum, which I regard as a specific character.

Paratypes of this species will be deposited in the Museum of the Bombay Natural History Society.

*Thisoicetrus nobilis*, sp. n.

Similar to the Mesopotamian *T. buxtoni* Uvarov, 1921, both in the type of coloration and in the relatively very large size, particularly in the female sex, but readily distinguished from it by the larger number of tibial spines.

♂.—(Antennæ missing.)

Face strongly oblique. Frontal ridge in profile practically straight; its surface weakly punctured, flat, with a small depression near the ocellus. Fastigium of vertex well projecting forward, elongate-oval, weakly concave, with a weak but continuous median line.

Pronotum above very weakly tectiform (less so than in *Th. pulcher* I. Bolivar); surface indistinctly punctured in prozona, and rather coarsely so in metazona. Median carina not interrupted by the transverse sulci, acute, practically straight in profile; typical sulcus somewhat behind the middle. Lateral carinæ smooth, not very regular, very weakly divergent in prozona, practically parallel and obsolescent in metazona. Lateral lobe rugulose and punctured, more densely so in metazona. Prosternal tubercle straight, round in section, slightly narrowed to the apex.

External genitalia as in *Th. pulcher*.

Elytra extending well beyond the apex of abdomen.

Hind femur relatively very long and slender, with the upper carina scarcely serrate. Hind tibia with 13 internal and 12 external spines.

General coloration light chocolate-brown, with a darker dorsal stripe of the same colour very sharply defined by the two light buff latero-dorsal stripes. Head with a large dark chocolate-brown subocular stripe, and with the edges of the frontal carina also dark brown. Elytra with a distinct light buff anal stripe; without spots. Wings pale bluish basally. Hind femur with an indistinct, narrow brownish stripe along the upper edge of the basal portion of externo-median area; interno-

median area with a corresponding stripe which is darker and wider; knee partly blackened, more widely so on the inside. Hind tibia pale vinaceous; the base brown, followed by a broad pale yellowish ring, followed in its turn by an incomplete brown ring. Spines white, black-tipped.

♀.—Much larger than the male. Frontal ridge weakly convex, not punctured. Fastigium of vertex rounded, transverse. Hind knee only with semi-lunar brown spots on both sides. Dark base and the dark post-basal ring of hind tibia are poorly defined.

Total length, ♂ 29, ♀ 53 (66); pronotum, ♂ 5.5, ♀ 10.5 (12); elytra, ♂ 24, ♀ 42 (52); hind femur, ♂ 19.5, ♀ 33 (37) mm. (Figures in brackets refer to the largest female paratype.)

BALUCHISTAN: Harnai, Sibi district, 9. viii. 1931, 1 ♂ (*type*), 1 ♀ (*M. Sharif*); Ambagh, Lasbela, 29. vi. 35, 1 ♀.

SIND: Sakrand, 24. vi. 38, 1 ♀ (*Harova Khan*).

PUNJAB: Lyallpur, 26. vii. 21, 1 ♂.

The degree of the sexual dimorphism in size is very striking.

*Euprepocnemis roseus*, sp. n. (Fig. 4, R.)

This is the first species of the genus with coloured hind wings, and it is also readily recognized by its small size and relatively short organs of flight.

♂.—Antennæ a little longer than head and pronotum together.

Face oblique, with fine scattered punctures. Frontal ridge flat in the region of the ocellus, weakly convex elsewhere, gradually widening and obsolescent towards the clypeus; surface rather densely punctured above the ocellus, and less densely so below it. Fastigium of vertex pentagonal, a little longer than wide, with the angles rounded; sloping sides of the fastigium are foveolate. No median carinula on vertex.

Pronotum relatively short, very obtusely tectiform above. Median carina well distinct, acute. Lateral carinæ distinct in prozona, where they are straight and weakly divergent backwards, and obsolescent in metazona, the sides of which are strongly punctured. All sulci very distinct; typical sulcus placed well behind the middle. Lateral lobe punctured and rugulose, more

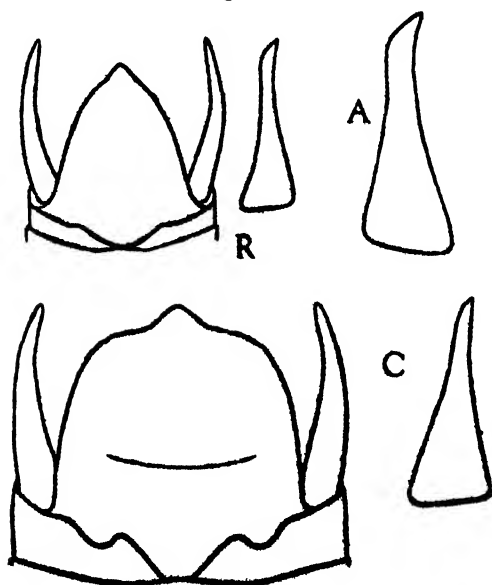


densely so in metazona, but with two smooth areas in the upper part of prozona.

Prosternal tubercle tongue-shaped, weakly compressed. Mesosternal lobes narrowly separated; metasternal ones contiguous.

Last tergite with a broad and shallow median excision, flanked by weak projections. Supra-anal plate elongate-triangular, with the sides rounded and a weakly-separated apical portion; its surface with a weak median depression

Fig. 4.



R. *Euprepochemis roseus*, sp. n., male supra-anal plate and cerci from above, and male cercus in profile; C, *E. cyaneosoma*, sp. n., ditto; A. *E. alacris* Serv., male cercus in profile.

in the basal half. Cercus longer than the plate; its shape as in *E. alacris* Serv. Sub-genital plate short, obtusely conical.

Elytra just reaching the apex of abdomen, narrowed apically; venation not dense.

Hind tibia with 8 external and 9 internal spines.

General coloration light brown. Head above with an elongate triangular brown fascia. Subocular sulcus black.

Pronotum with the brown discal spot usual in the genus, which is practically parallel-sided in prozona and narrowed posteriorly in metazona; lateral lobe with an imperfectly outlined oblique brownish fascia in the upper part of prozona. Elytra with a few fairly large pale brown spots; most of the veinlets whitish. Wings light rose basally. Hind femur with three fairly large, but not sharply outlined, oblique brown spots in the upper half of the externomedian area, and with similar fasciæ in the internomedian area; knee laterally black, but the knee-lobes yellowish white except basally. Hind tibia in the basal part brownish black, with two yellowish-white rings; the apical part, occupying more than half the length, is light red.

♀.—Elytra reaching to the middle of the supra-anal plate.

Total length, ♂ 19, ♀ 27; pronotum, ♂ 4, ♀ 5; elytra, ♂ 11, ♀ 16; hind femur, ♂ 10.5, ♀ 15 mm.

PUNJAB: Simla, 3500-5500 ft., xi.-xii. 1925, 5 ♂♂ (including the *type*), 6 ♀♀; Simla Hills, 5700 ft., 1926, 3 ♀♀ (*A. E. Jones*).

UNITED PROVINCES: Dehra Dun, various dates, 3 ♂♂, 6 ♀♀.

ASSAM: Shillong, 5000 ft., 15. xi. 1924, 1 ♂ (*Fletcher*).

The Assam specimen has hind wings discoloured, but is typical otherwise.

Paratypes will be deposited in the Forest Entomologist's collection at Dehra Dun, as well as in the Indian Museum, Calcutta, and the Agricultural Research Institute, New Delhi.

*Euprepocnemis cyanescens*, sp. n. (Fig. 4, C.)

A robustly built species, with relatively short elytra, bluish wings and greyish blue hind tibiæ, differing from *E. alaois* (Serville, 1838) also by the shorter, basally broader and less spatulate male cercus (compare figs. 4, C and 4, A).

♂.—(Antennæ missing in the type.)

Face moderately oblique, with large but shallow punctures. Frontal ridge broadly convex in profile; surface weakly convex throughout, except for a very shallow depression round the ocellus, with sparse and small punctures. Fastigium of vertex elongate pentagonal, a little

longer than wide, weakly concave; its sloping sides are deeply and irregularly punctured. Vertex between the eyes with a fine raised line, which can scarcely be regarded as a carinula.

Pronotum stout, very obtusely tectiform above. Median carina acute. Lateral carinæ in prozona thick, weakly divergent; in metazona obsolescent and weakly curved; sides of metazona deeply, but not very densely punctured. All sulci very distinct; typical sulcus well behind the middle. Lateral lobe foveolate in prozona, except two large smooth areas in its upper part; in metazona densely punctured and rugulose.

Prosternal tubercle somewhat incrassate apically, distinctly transverse and with a weak longitudinal depression on the frontal surface. Mesosternal interspace almost quadrate; metasternal lobes narrowly separated.

Last tergite with a deep, but not broad, median excision, flanked by distinct projections. Supra-anal plate elongate-pentagonal, with rounded sides and distinctly separated apical portion; its surface with a fine transverse furrow before the middle. Cercus as long as the plate; it is broad basally and gradually narrowed to the subacute apex. Subgenital plate short, globular.

Elytra just reaching the base of supra-anal plate, narrowed apically; venation fairly dense.

Hind femur relatively short and stout. Hind tibia with 9 spines on each side.

General coloration light castaneous. Head above with a chocolate-brown stripe, enclosed between two light buff stripes. Subocular sulcus chocolate-brown. Pronotum with the usual discal spot of deep velvety brown, which is narrowed both in front and behind; lateral lobe in its upper half mostly chocolate-brown, this colour extending along the sulci on to the lower half, which is mainly buff. Abdomen with a series of large lateral brown spots; sides of supra-anal plate brown. Elytra with large brown spots, and a broad buff anal stripe. Wings faintly bluish basally, infumate apically, with thick brown veins. Hind femur with three large oblique black spots on both sides; knee only narrowly bordered with brown along the carina. Hind tibia basally yellowish, with two brown rings; apical half greyish blue; spines white basally, black apically.

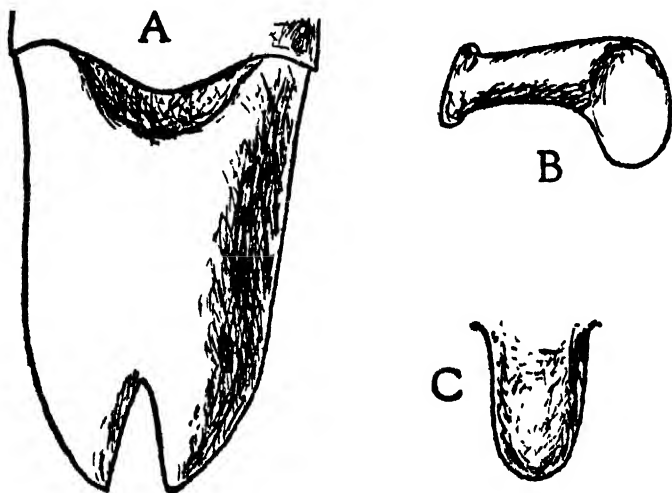
Total length 29 ; pronotum 7 ; elytra 16 ; hind femur 19 mm.

MADRAS : Courtallam Hills (Tinnevely district) 24. v.-2. vi. 1917, 1 ♂.

*Cataloipus indicus*, sp. n. (Fig. 5.)

The genus *Cataloipus* has been known so far as a purely African one, with a single species in south-western Arabia, where there is a strong Ethiopian faunistic influence, and the occurrence of a *Cataloipus* in India is a fact of zoogeographical interest.

Fig. 5.



*Cataloipus indicus*, sp. n., ♂. A, subgenital plate, ventral view ; B, right cercus, lateral view ; C, prosternal tubercle, posterior view.

Systematics of species of *Cataloipus* are not in good order, and the only recent revision is by Sjöstedt (1929, Ark. Zool., 20 A, No. 15, pp. 32-39). In the key given by that author, the new Indian species runs down to the group of *eximius-zuluensis*, and resembles the last-named species in the coloration of hind tibia, but differs from it in the shorter prosternal tubercle, longer elytra and the

shape of the male cercus, which is curved almost under a right angle. The Arabian *C. thomasi* Uvarov, 1933, differs from the new species by the shape of the prosternal tubercle, coloration of hind tibia and shorter elytra.

♂.—Face and frontal ridge with scattered, fairly large punctures. Fastigium of vertex with two irregular, shallow and weakly punctured depressions, separated by a weak median line.

Pronotum coarsely punctured, more particularly so in the metazona. Anterior margin rounded, posterior truncate. Prosternal tubercle tongue-shaped, compressed, inclined backwards.

Elytra extending beyond hind knees. Hind femur moderately elongated.

Last tergite with a pair of widely separated, small triangular projections. Supra-anal plate rounded-triangular, distinctly longer than wide. Cercus with the apical half expanded and decurved under what is almost a right-angle. Subgenital plate relatively narrow, ascendant; apical excision deep, narrowly triangular.

General coloration greenish buff, with the usual pattern. Hind femur with a brown line along the upper edge of the externo-median area reaching the middle of the length; knee black, except the knee-lobe, which is whitish. Hind tibia greyish blue, with a slightly paler post-basal ring; spines white, black-tipped.

♀.—Elytra extending beyond hind knees. Externomedian area of the hind femur along the upper edge with a black stripe, which is narrowed in its middle.

Total length, ♂ 38, ♀ 52; pronotum, ♂ 7, ♀ 9.5; elytra, ♂ 29, ♀ 44; hind femur, ♂ 24, ♀ 36 mm.

RAJPUTANA: Sikar, Jaipur State, 20. ix. 34, 1 ♀.

UNITED PROVINCES: Delhi, at light, 6. ix. 37, 1 ♀ (*Kerr*); 9. ix. 37, 1 ♂ (*type*) (*Nigam*); Cawnpore, 17. ix. 35, 1 ♀; 16. viii. 36, 1 ♂; Unao, 17. ii. 29, 1 ♀ (*H. N. Sharma*).

A paratype from Rajputana belongs to the Indian Museum, Calcutta.

### *Habrocnemis shanensis*, sp. n. (Fig. 6.)

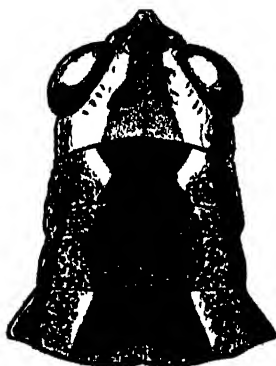
The genus *Habrocnemis* has been described by me for a species from the Szetchuan province of China, *H. sinensis* Uvarov, 1930 (*Ann. & Mag. Nat. Hist.* ser. 10, vol. v. p. 253; also Chang, 1937, *Notes d'Entom. Chinoise*,

Musée Heude, vol. iv. fasc. 8, p. 194). The following new species from the S. Shan States of Burma differs from *H. sinensis* by pointed prosternal tubercle, pronotum shallowly excised behind, pronotal pattern, and the coloration of the hind femur.

♀.—Antennæ a little longer than head and pronotum, somewhat compressed.

Face rugulose and punctured. Frontal ridge viewed in profile practically straight, only slightly projecting forward in the upper portion ; its surface with dense and deep

Fig. 6.



*Habroonemis shanensis*, sp. n., ♀.

punctures above the ocellus, concave for some distance below the ocellus, coarsely foveolate near the clypeus. Lateral facial carinæ distinct, smooth, weakly curved. Cheeks foveolate and furrowed. Fastigium of vertex weakly sloping, triangular, shallowly concave ; margins moderately raised, incurved behind ; foveolæ of vertex irregularly rounded-triangular. Vertex between the eyes and occiput with a weak median carinula and some irregularly branching rugosities.

Pronotum stout, even somewhat inflated, with coarsely foveolate and rugose surface. Front margin broadly rounded ; hind margin shallowly excised in the middle. Disc somewhat inflated between the first and the last sulcus, obtusely tectiform in front of the first sulcus and

in metazona, which is half the length of prozona ; all sulci deep. Median carina sharp and smooth, weakly convex in profile ; no definite lateral carinæ, though the disc forms a broadly rounded angle with the lateral lobe. Lateral lobe narrowed below ; surface convex in the upper portion of prozona and broadly concave below ; front margin broadly sinuate ; lower margin strongly sinuate ; lower hind angle obtuse, rounded. Prosternal tubercle short, pyramidal in shape, the posterior surface being flat and the anterior obtusely roof-shaped ; apex acute. Mesosternal lobes short, strongly transverse ; their interspace a little wider than a lobe. Metasternal interspace weakly transverse. Metanotum with an obtuse median carina and a transverse ridge-like fold of integument near the hind margin.

Elytra widely separated dorsally, elongate-oval, widest behind the middle.

Abdomen rugulose and punctured ; tergites with a low median carinula.

Hind femur thick, with the upper margin strongly serrate. Hind tibia with 6-7 external spines and 8 internal ones.

Coloration castaneous brown. Face mottled with brown and black ; palpi ivory-white. Fastigial concavity velvety black, the colour spreading, but becoming diluted, along the middle of the vertex and occiput. Pronotal disc bears a medially constricted velvety-black spot in front of the first sulcus, and a trapezoidal spot of the same colour on the metazona ; the swollen middle portion of the disc between these spots is somewhat darker than the sides of the disc ; lateral lobe with a rounded buff spot at the lower margin, above which there is an indefinite blackish fascia. Elytra with a few minute blackish spots. Hind femur below sealing-wax-red ; inner face brownish-black, with an oblong buff spot at the upper edge near the base, and two buff fasciæ near the apex ; upper area with a broad blackish fascia, extending obliquely on to the externomedian area ; knees not darkened. Hind tibia sealing-wax-red ; spines black-tipped.

Total length 28 ; pronotum 5.5 ; elytra 5 ; hind femur 13 mm.

BURMA : Southern Shan States, near Loinwe, Pangwai, 5000 ft., 1937, 1 ♀ (British Museum ; received through Prof. F. J. Meggitt).

## BURMACRIS, gen. nov.

Superficially similar to the African *Metaxymecus* Karsch, but not closely related to it, differing in strongly oblique face, flat and marginated fastigium of vertex, and non-elongate second joint of hind tarsus; possibly related to the South Indian *Euprepocnemides* I. Bolivar, 1914, not known to me from specimens, but differing from its description in the sulcate frontal ridge, medially carinate fastigium of vertex, elytra non-contiguous dorsally, male subgenital plate not bituberculate apically, and acute hind genicular lobes.

Antennæ probably long, filiform (damaged in the type). Face strongly oblique; frontal ridge well raised, sulcate in the lower half. Lateral ocellus close to the margin of fastigium. Fastigium of vertex practically horizontal, flat, rounded, with distinct continuous margins and a median carinula. Eyes oval; their horizontal diameter slightly exceeds the subocular distance. Pronotum elongate; disc very obtusely tectiform, truncate behind; median carina very distinct, low; lateral carinae thick, straight, weakly divergent backwards; all sulci deep, cutting all carinae; typical sulcus at two-thirds of the length; lateral lobe narrowed downwards, a little longer than high, with the lower margin strongly bi-sinuate. Prosternal tubercle short, apically truncate, weakly compressed. Mesosternal lobes transverse, rectangular; their interspace parallel-sided, more than half the width of a lobe. Metasternal lobes contiguous. Abdominal tympanum almost completely open. Last tergite widely interrupted in the middle, with a pair of lobules. Supra-anal plate elongate, rounded-pentagonal. Cercus short, laterally compressed, weakly incurved and decurved. Subgenital plate very short, rounded. Elytra lateral, not contiguous dorsally; apex acute. Hind femur relatively long, basally thick; knee-lobes subacute; apex of the knee with a small spinule above. Hind tibia with seven outer spines, the three distal ones being distinctly longer than the others; no outer apical spine; inner spines nine in number, including the apical one, three proximal ones gradually increasing in length, three middle ones of equal length, the rest again decreasing. Hind tarsus of normal structure. All tarsal arolia as long as claws, broadly rounded.

Genotype: *Burmacris plagiata*, sp. n.



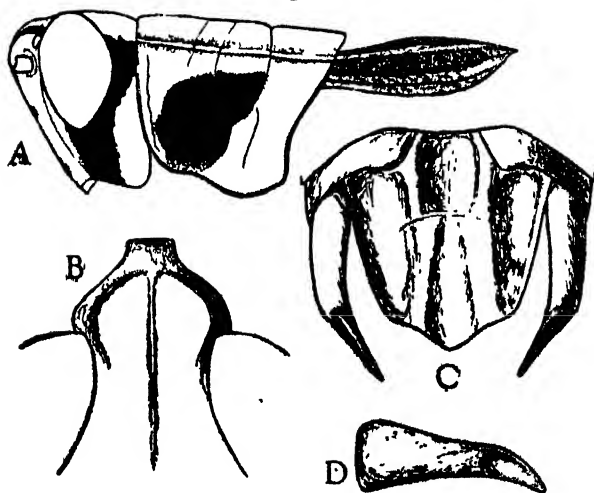
While resembling *Metaxymecus*, the new genus occupies a rather isolated position in the group Euprepocnemi, on account of the structure of its vertex.

*Burmaoris plagiata*, sp. n. (Fig. 7.)

Face with weak and obtuse punctures; frontal ridge with a few scattered punctures; cheeks obtusely rugulose and punctured. Fastigium of vertex weakly transverse.

Pronotal disc rugulose near the anterior margin and in metazona; lateral lobe punctured and rugulose in the lower part of prozona and in the metazona.

Fig. 7.



*Burmaoris plagiata*, gen. et sp. n., ♂. A, head, pronotum and elytron; B, vertex; C, last tergite, supra-anal plate and cerci; D, left cercus in profile.

Elytra extending a little beyond the first tergite, elongate, with the apex attenuate; costal margin strongly rounded.

Lobules of the last tergite small, broader than long, widely distant. Supra-anal plate somewhat raised along the middle, very shallowly sulcate in the basal half. Cercus a little longer than supra-anal plate, compressed throughout, but more strongly so at the apex, which is decurved.

General coloration light brownish with the following markings in blackish brown:—Underside of antenna;

streaks on the margins of frontal ridge immediately below the ocellus; lower edges of the fastigium of vertex; a large post-ocular spot extending below on to the anterior portion of the cheek; a large and highly polished oblique spot occupying most of the prozona of pronotal lobe; lower portion of the metapleura; a series of lateral abdominal spots; lateral margins of supra-anal plate in their basal halves. The postocular and the lateral pronotal spots are both followed by ivory-yellow spots. Lateral pronotal carinae light buff. Elytra castaneous, with a buff stripe. Hind femur in the externomedian area mostly black, with an oblique basal, a median and a preapical light buff fasciae; lower outer sulcus light buff with a black postmedian fascia; internomedian area light buff with two black fasciae; knee black all round. Hind tibia ivory-white on the outer side; light brown on the inner; dark brown along the upper side (between spines), with the base and a postbasal ring black; spines white, with the hind margins and tips black.

Total length 23; pronotum 5.5; elytra 5.2; hind femur 16 mm.

BURMA: Pegu Yomas, 400 ft., 60 miles N. of Rangoon, 1933, 1 ♂ (*F. J. Meggitt*).

**XLVIII.**—*Spolia Mentawiensis*: *Rhopalocera*, Satyridae and Amathusiidae. By A. STEVEN CORBET, British Museum (Natural History).

THE butterflies dealt with in this paper form part of the collection made in the Mentawi Islands in 1924 by Messrs. C. Boden Kloss and N. Smedley; the few specimens taken by Dr. H. H. Karny, who visited the islands at the same time, are placed in brackets.

#### Satyridae.

*Ypthima philomela philomela* (L.). Padang, 3 ♂♂, 4 ♀♀.

*Ypthima baldus mærus* Fruh. Siberut, 3 ♂♂, 3 ♀♀; Padang, ♀.

There has been some confusion of the smaller Malaysian species of *Ypthima*, but the accompanying key and

Fig. 1.

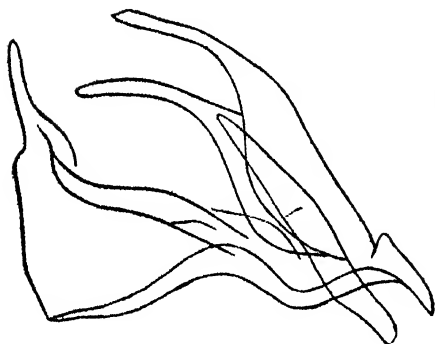


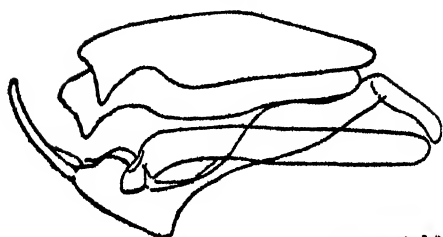
Fig. 2.



Fig. 3.



Fig. 4.



Figs. 1-4.—Male genitalia of (1) *Ypthima kubneri kubneri* Kirby, Malaya. (2) *Y. lieandra lieandra* (Cr.), Hong Kong. (3) *Y. baldus newboldi* Dist., Malaya, (4) *Y. philomela philomela* (L.), Malaya.

figures (1-4) of the male genitalia should leave little doubt as to identification.

- 1 (4). Underside of hindwing with the ocelli in spaces 1 c, 2 and 3 in line.
- 2 (3). Underside of hindwing with a single subapical ocellus in space 6..... *Y. hübneri* Kirby.
3. Underside of hindwing with two subapical ocelli, one in space 6 and a smaller one in space 7..... *Y. lisandra* (Cr.).
4. Underside of hindwing with the ocelli in spaces 1 c, 2 and 3 not in line, that in space 1 c nearer the margin.
- 5 (6). Underside of hindwing with the ocellus in space 1 c double and comprising 2 small spots, of which the anterior one is the larger ..... *Y. baldus* (F.).
6. Underside of hindwing with the ocellus in space 1 c double and comprising 2 small equal spots ..... *Y. philomela* (L.).

*Ypthima pandocus mentawica* Hagen. Siberut, 25 ♂♂, 16 ♀♀ (♂, ♀); Sipora, 23 ♂♂, 6 ♀♀; North Pagi Is., ♂, ♀.

*Ypthima pandocus corticaria* Btlr. Pulau Tello, 4 ♂♂, 2 ♀♀; Padang, 2 ♂♂, 2 ♀♀.

*Lethe mekara manis*, subsp. n. Sipora, 9 ♂♂, 7 ♀♀ (2 ♀♀).

♂.—Upperside as in subsp. *gopaka* Fruh., from Malaya, and subsp. *debata* Fruh., from Sumatra. Underside differs from these races in that the dark post-discal line is irregular above vein 4 on the forewing and not straight to vein 7, and is more angled between veins 3 and 5 on the hindwing; the hindwing submarginal ocelli are dark blackish brown and not pale olive as in Malaya and Sumatra. Forewing 31 mm.

♀.—Upperside deeper brown than in *gopaka* and *debata* and without an ochreous hue; the inner edge of the series of white discal spots is rather diffuse and not clearly defined. Underside with the brown areas darker than in Malaya and Sumatra and the hindwing submarginal ocelli deep blackish brown as in the male. Forewing 32 mm. (B.M. Types Rhop. Nos. 496 and 497.)

I can detect no differences between the Malayan and Sumatran races of *L. mekara* (Mre.) in the short series in the British Museum.

*Mycalesis janardana sagittigera* Fruh. Padang, ♂.

***Mycalesis horsfieldii siporana***, subsp. n. Sipora, 10 ♂♂, ♀.

♂♀.—Nearest to subsp. *niasana* Fruh., from Nias, but the upperside is darker and the subternal spots on the hindwing are larger and more prominent. On the underside, the white submarginal lines are sullied and the white post-discal lines are narrower and dark-dusted; the submarginal ocelli are larger, but those in spaces 1b, 3 and 4 on the forewing are obsolete and those in spaces 4 and 5 on the hindwing are small and tend towards obsolescence. ♂ forewing 22.5 mm.; ♀ forewing 26.0 mm. (B.M. Types Rhop. Nos. 15003 and 15004.)

The species in the *mineus* group of the genus *Mycalesis* Hbn. have been revised on the basis of the male primary and secondary sexual characters by Talbot and Corbet (1939, J. F. M. S. Mus. xviii. p. 406).

***Mycalesis horsfieldii niasana*** Fruh. Pulau Tello, ♂, ♀.

***Mycalesis fuscum karnyi***, subsp. n. Siberut, ♂ (2 ♂♂); Sipora, ♂.

♂.—Upperside darker brown and lacking the ochreous hue found in subsp. *fuscum* (C. & R. Feld.), from Malaya and Sumatra, and subsp. *musculus* Fruh., from Nias; the hindwing submarginal ocelli less prominent, only the ocellus in space 2 being easily visible. Underside darker brown than in allied races, but markings as in subsp. *musculus*. Larger than in allied races. Forewing 23.5 mm. Type from Siberut (B.M. Type Rhop. No. 15002).

***Mycalesis orseis orseis*** Hew. Padang, 2 ♂♂.

***Mycalesis malaneas neas***, subsp. n. Siberut, ♂; Sipora, 5 ♂♂.

♂.—Upperside nearer to subsp. *maianeas* Hew., from Borneo, than to subsp. *maia* Nic., from Sumatra, but differs in the absence of any orange subapical colouring on the forewing and in the more obscure ocellus in space 2. Underside with the forewing subapical area less brightly coloured ochreous and the hindwing violaceous discal band broader and straighter than in subsp. *maianeas*. Forewing 23 mm. Type from Sipora (B.M. Type Rhop. No. 473).

The single Siberut male shows some ochreous colouring in the subapical area of the forewing above, while the

violaceous discal band on the hindwing beneath is more like that found in the Bornean form.

***Mycalesis dohertyi tuanda***, subsp. n. Siberut, 4 ♂♂; Sipora, 18 ♂♂, ♀ (2 ♂♂, ♀).

♂♀.—Upperside paler than in the nominotypical form from Malaya, with the ocelli on both wings more obscure, the yellow rings being obsolete, and the pale post-discal band showing through from the underside more clearly indicated. The male is more purple-brown than in *dohertyi* El.

Underside paler and more ochreous than in *dohertyi*, and the dark brown shading on the inner edge of the pale post-discal band is narrower. The dark basal shading of *dohertyi* is indicated in subsp. *tuanda* by a narrow dark brown subbasal line. The submarginal ocelli as in *dohertyi*, but the forewing has ocelli in spaces 4, 5 and 6, and, usually, very minute ocelli in spaces 3 and 7, and, rarely, in space 1*b*; on the hindwing, the upper ocellus in space 1*c* and the ocellus in space 3 are smaller than the corresponding ocelli in *dohertyi*. ♂ forewing 24 mm.; ♀ forewing 25 mm. Types from Sipora (B.M. Types Rhop. Nos. 15005 and 15006).

It is surprising that this rare species, hitherto known only from Malaya, Sumatra and Borneo, was obtained in such numbers in the Mentawi Islands. Apart from the specimens recorded here, it is doubtful if 20 examples are known.

***Orsotriana medus telloana***, subsp. n. Sipora, ♀; Pulau Tello, 9 ♂♂, 3 ♀♀, including a pair taken *in cop*.

♂♀.—Upperside dark brown and lacking the ferruginous hue found in the other Malaysian races. Underside with the white discal band broader, particularly so on the hindwing. ♂ and ♀ forewing 21 mm. Types from Pulau Tello (B.M. Types Rhop. Nos. 500 and 15001).

The Sipora female hardly differs from subsp. *cinerea* (Btlr.), from Malaya and Sumatra, but it is probably better to place it under the Tello race.

***Orsotriana medus cinerea*** (Btlr.). Padang, ♀.

From the material in the British Museum, it appears that *zipadina* Fruh., from Sumatra, is not separable from the Malayan subspecies *cinerea* (Btlr.).

**Ragadia makuta arpeta**, subsp. n. Siberut, 10 ♂♂, 7 ♀♀ (♂); Sipora, 11 ♂♂, 8 ♀♀ (2 ♂♂, 2 ♀♀).

♂. Upperside paler than in the Sumatran subsp. *minoa* Fruh., while ♀ above resembles the nominotypical form from Java, except that the hindwing is not noticeably paler than the forewing. Underside with a faint ochreous tinge, and the tornal area slightly ochreous dusted as in *makuta* (Hsf.). ♂ forewing 22 mm.; ♀ forewing 23 mm. Types from Siberut (B.M. Types Rhop. Nos. 494 and 495).

**Melanitis phedima morosa**, subsp. n. Sipora, 5 ♂♂, 3 ♀♀.

♂.—Differs from subsp. *abdullæ* Dist., from Malaya and Sumatra, and subsp. *sumati* Fruh., from Nias, in lacking the ferruginous colour at the outer margins on the upperside, and in the darker apical area on the forewing and the more obscure submarginal spots on the hindwing on the underside. Forewing 33 mm.

♀.—Upperside darker brown than in *abdullæ*, from Sumatra, the forewing apical area darker and unmarked except for an irregular obscure black submarginal spot. Underside darker and more uniformly coloured than in *abdullæ*, and with the hindwing submarginal spots more obscure. Forewing 35 mm. (B.M. Types Rhop. Nos. 498 and 499.)

**Elymnias panthera mira**, subsp. n. Siberut, ♀; Sipora, 2 ♂♂, ♀.

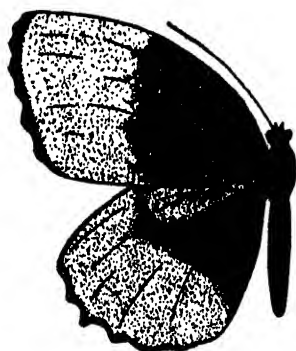
♂♀.—Upperside darker than in subsp. *dolorosa* Btlr., from Nias, with the marginal areas paler and lacking an ochreous or ferruginous hue in the male, but faintly ochreous in the female. Underside darker brown than in *dolorosa*, with the reddish hue much reduced and the hindwing submarginal spots more elongated. ♂ forewing 32 mm.; ♀ forewing 35 mm. Types from Sipora (B.M. Types Rhop. Nos. 15007 and 15008).

**Elymnias nelsoni**, sp. n. Sipora, ♂. (Fig. 5.)

♂.—Wing-shape near to *Elymnias casiphone satleri* Dist., but the forewing has the apex and tornus more quadrate and the termen straighter. The forewing termen is not so deeply indented as in *satleri*, while the hindwing termen is more so.

Upperside with basal half of each wing black, outer distal half pale lavender-blue. The blue area is inwardly diffuse and separated from the distal margin by a narrow black strip about 1 mm. broad on the forewing and less on the hindwing. Cilia black, but white between the projections. The hindwing has a nacreous area extending from the costa to the middle of the cell. The hair-tufts are as in *E. casiphone* Geyer, that is, a short basal greyish-brown tuft followed by a second longer tuft lying along the middle of the cell. In *E. casiphone*, the underlying hairs in this second tuft are paler in colour than the

Fig. 5.



*Elymnias nelsoni*, sp. n.

♂ Holotype. (Antennæ missing in specimen.)

surface hairs; in *E. nelsoni* the greyish brown surface hairs overlie a tuft of pale yellowish white hairs.

Underside as in *E. casiphone sateri*, but the colour is deep greyish black and lacks the reddish hue found in *sateri*, and the markings are not so distinct. The greyish nacreous area on the forewing as usual in *E. casiphone* forms. Forewing 35 mm. (B.M. Type Rhop. No. 15009.)

There is little doubt that *E. nelsoni* is a vicarious form of *E. casiphone*, but the altered wing-shape and the entirely different facies on the upperside almost preclude their being regarded as conspecific.

This remarkable new species is named after David Nelson, the botanist, who was one of the first collectors



of natural history specimens in Malaysia. Nelson sailed with Captain James Cook on his third voyage (1776-1780), and then with Captain William Bligh on the ill-starred expedition of H.M.S. 'Bounty' to Tahiti. He perished at Timor, in 1789, after surviving the journey from Tahiti in an open boat.

### Amathusildæ.

*Faunis canens pallidior* (Hagen). Siberut, 5 ♂♂, ♀ (2 ♂♂); Sipora, 22 ♂♂, 20 ♀♀ (♀).

*Faunis canens samadhi* Fruh. Pulau Tello, 4 ♀♀.

*Xanthotænia busiris polychroma* Hagen. Siberut, 3 ♂♂, 4 ♀♀ (3 ♂♂); Sipora, 22 ♂♂, 6 ♀♀ (♂, 3 ♀♀).

*Amathusia phidippus niasana* Fruh. Sipora, ♂.

The specimen, which is not separable from Niasese males, has the faded underside so typical of *A. phidippus* races from small islands in Malaysia.

*Amathusia phidippus eutropius* Fruh. Padang, ♂, ♀.

*Zeuxidia amethystus zambra*, subsp. n. Siberut, 2 ♂♂, ♀; Sipora, 2 ♂♂, 2 ♀♀.

♂.—Upperside differs from subsp. *amethystus* Btlr., from Malaya and Sumatra, and *wallacei* C. & R. Feld., from Borneo, in the less oblique purple-blue subapical band on the forewing and in the more extensive purple-blue tornal patch on the hindwing, which extends to vein 5. Underside colouring more uniform, lacking the rich reddish tones. Forewing 45.5 mm.

♀.—Upperside with the forewing subapical markings slightly yellower, more maculate and more restricted than in Neomalayan races, and with the hindwing distal margin more broadly washed with ochreous. Underside very like Malayan *amethystus* but slightly more ochreous. Forewing 53.0 mm.

Both sexes lack the pale apical patch on the forewing above, which is found in Neomalayan races. Types from Siberut (B.M. Types Rhop. Nos. 15010 and 15011).

*Zeuxidia doubledall sellada*, subsp. n. Sipora, ♂.

♂.—Upperside differs from the nominotypical form from Malaya and Sumatra in the less oblique and less

strongly arched purple-blue subapical band on the forewing, and in lacking the pale diffuse apical spot on the same wing. Underside more uniformly coloured than in *doubledarii* Westw., much darker ferruginous brown, faintly violet washed and without the pale shading. Forewing 45 mm. (B.M. Type Rhop. No. 15012.)

CORRIGENDA.—In the list of Mentawi Pieridæ (Corbet, 1941, Ann. & Mag. Nat. Hist. (11) viii, p. 498, line 4 from bottom), for "*Saletara panda auriflora* Fruh." read "*Saletara panda aurifolia* (Fruh.)." On page 501, line 4 from bottom, for "Fig. 2" read "Fig. 3"; on following line for "Fig. 3" read "Fig. 2."

**XLIX.—*Spolia Mentawiensis*: *Rhopalocera*, Nymphalidæ.**

By A. STEVEN CORBET, British Museum (Natural History).

THE butterflies dealt with in this paper form part of the collection made in the Mentawi Islands in 1924 by Messrs. C. Boden Kloss and N. Smedley; the few specimens taken by Dr. H. H. Karny, who visited the islands at the same time, are placed in brackets.

*Cupha erymanthis peliopteryx* (Hagen). Siberut, 23 ♂♂, 4 ♀♀; Sipora, 26 ♂♂, ♀; North Pagi Is., 2 ♂♂, ♀ (2 ♂♂).

At first sight, the uniform colouring of the upperside of this distinct subspecies suggests a *Cirrochroa* form rather than a race of *C. erymanthis* (Drury).

*Cupha erymanthis nagara* Fruh. Padang, 8 ♂♂, 6 ♀♀.

*Vindula erots manis*, subsp. n. Siberut, 2 ♂♂ (♂); Sipora, 6 ♂♂; North Pagi Is., 2 ♂♂.

♂.—Upperside resembles subsp. *battaka* (Mart.), from North-east Sumatra, but the forewing apex is only slightly dark dusted, the post-discal spots in spaces 5 and 6 being visible, and the hindwing ocelli in spaces 2 and 5 are larger and almost entirely black. Underside as in *battaka*, but the basal area bounded by the dark median line is not pink but unicolourous with the post-discal area; the areas distal to the outer dark longitudinal lines are darker than the rest of the wing.

Wing-shape as in *battaka*, except that the hindwing tail is much longer, being nearly as long as in *V. arsinoë erotoides* (Nic.), but broader. Forewing 39 mm. Type from Sipora (B.M. Type Rhop. No. 15015).

The presence of a strongly curved "processus superior" (vide Roepke, 1938, Proc. R. ent. Soc. Lond. (B) vii. p. 85) in the male genitalia confirmed the identity of the Mentawi specimens with *V. erota* (F.); in *V. arsinoë* (Cr.), the "processus superior" is almost straight. In Malaysia, *V. erota* prefers the hills, while *V. arsinoë* is found on the plains and rarely ascends above 3000 feet. The presence of *V. erota* on the Mentawi Islands, therefore, is surprising. According to van Eecke (1914, Notes Leyden Mus. xxxvi. p. 230, fig. 4 C (♂ gen.)), the Niasese form *orahilia* (Kheil) is an *erota* race, but no information is forthcoming regarding *simalurensis* (van Eecke), from Simalur. Pendlebury (1939, J. F. M. S. Mus. xviii. p. 388) has established that *tiomana* (Pend.) and *rafflesi* Pend., from Pulau Tioman and Pulau Aor, respectively (both islands off the east coast of the Malay Peninsula), are *arsinoë* forms.

*Vindula arsinoë erotoides* (Nic.). Padang, ♀.

Examination of extensive material from the Malay Peninsula has shown that the females of *V. erota* and *V. arsinoë* are correctly separated and figured by Pendlebury (1939, loc. cit. pl. vi. figs. 9 (*arsinoë*) and 12 (*erota*)).

*Cirrochroa emalea miranda*, subsp. n. Sipora, 9 ♂♂, 5 ♀♀.

Both sexes resemble subsp. *lapaona* Kheil, from Nias, in the large black post-discal spots on the upperside of the hindwing and approach subsp. *bajadeta*, Mre., from Java, in the duskier and more steely shading towards the outer margins on the underside.

♂♀.—Upperside forewing black marginal border broader than in subsp. *ravana* Mre., from Borneo, and with diffuse black stripes in spaces 1*b*, 2 and 3 on the inner edge of the black border. ♂ colour more ochreous than in *lapaona*, particularly in the post-discal area of the forewing. ♀ colour less reddish than in *lapaona*, and with the black post-discal spots rather smaller.

Underside with the black post-discal spots on the hindwing larger and more diffuse than in the Niasese form

and with a similar spot in space 1b on the forewing.  
♂ forewing 35.0 mm.; ♀ forewing 30.5 mm. (B.M. Types  
Rhop. Nos. 15013 and 15014.)

*Cethosia hypsea pallaurea* Hagen. Siberut, 6 ♂♂, 3 ♀♀;  
Sipora, 2 ♂♂, 7 ♀♀.

*Cethosia hypsea batuensis* Stich. Pulau Tello, ♂.

The only important differences between *batuensis* and *pallaurea* appear to be the narrowing of the forewing whitish subapical band towards the costa in *batuensis* and in the orange ground-colour on the underside of the hindwing in the same subspecies extending right up to the white marginal lunules.

*Precis iphita tosca* Fruh. Pulau Tello, 5 ♂♂ (2 ♀♀);  
Padang, ♂, ♀.

*Precis hedonia ida* (Cr.). Padang, 17 ♂♂, 5 ♀♀.

*Precis atlites atlites* (L.). Siberut, 12 ♂♂ (♀); Sipora,  
19 ♂♂, 4 ♀♀; North Pagi Is., 3 ♂♂; Pulau Tello,  
3 ♂♂; Padang, ♂.

*Precis almana javana* (C. Feld.). Mentawi Is., ♀; North  
Pagi Is., ♂; Pulau Tello, ♂; Padang, ♂.

*Symbrenthia hippoolus emas*, subsp. n. Siberut, 19 ♂♂,  
5 ♀♀; Sipora, 18 ♂♂, 5 ♀♀ (♂).

♂♀.—Differs from subsp. *niasica* Mre., from Nias, in the darker post-discal fascia on the hindwing beneath. ♂ forewing 23 mm.; ♀ forewing 25 mm. Types from Siberut (B.M. Types Rhop. Nos. 15016 and 15017).

In males of subsp. *batunensis* Fruh., from the Batu Islands (no females seen), the orange markings are paler and broader than in *niasica* or *emas*.

*Hypolimnias antilope discandra* Weym. Siberut, ♂;  
Sipora, 8 ♂♂.

*Doleschallia bisaltide niasica* Btlr. Sipora, ♂.

*Chersonesia rahria apicusta* Hagen. Siberut, 2 ♂♂,  
6 ♀♀ (♀); Sipora, 15 ♂♂, 17 ♀♀ (2 ♀♀).

*Chersonesia rahria sanna* Fruh. Pulau Tello, 4 ♂♂  
(2 ♀♀).

*Chersonesia peraka peraka* Dist. Siberut, ♀ (♀); Sipora, 2 ♀♀ (♂); North Pagi Is., ♀ (♀).

*Pantoporia hordonia sura*, subsp. n. Siberut, 3 ♀♀ (♀); Sipora, (♂); North Pagi Is., ♀.

♂.—Upperside with the orange cell-streak on the forewing and the orange median band on the hindwing narrower, and the forewing greyish-blue submarginal line broader than in subsp. *senthes* (Fruh.), from Sumatra. Underside of the hindwing with the subbasal fascia darker and the distal edge of the median band blacker than in *senthes*. Forewing 22.5 mm. Type from Sipora (B.M. Type Rhop. No. 15018).

♀.—Upperside with the orange markings much narrower than in *senthes*, and the forewing greyish-blue submarginal line broader. Underside with the markings much darker and the greyish-blue sinuate submarginal lines on both wings much broader. Forewing 24.0 mm. Type from Siberut (B.M. Type Rhop. No. 15019).

*Pantoporia paraka confluens* (Hagen). Siberut, 2 ♂♂, 2 ♀♀ (♀); Sipora, ♀.

*Neptis hylas hageni* Fruh. Siberut, 21 ♂♂, 14 ♀♀ (2 ♀♀); Sipora, 34 ♂♂, 18 ♀♀ (5 ♀♀).

*Neptis hylas hatra* Fruh. Pulau Tello, ♂, 2 ♀♀ (♂; ♀).

*Neptis hylas papaja* Mre. Padang, 7 ♂♂, 3 ♀♀.

*Neptis magadha kerosa*, subsp. n. Siberut, ♀ (♂); Sipora (♀).

♂♀.—Upperside differs from subsp. *phylasia* Fruh., from Sumatra, in the broader, white post-discal markings on the forewing, and in the broader, white median band on the hindwing. On the forewing, the white post-discal spot in space 3 is almost as large as that in space 2 and the hindwing median band is broadened in the centre. Underside with the ground-colour darker and without an ochreous hue; white markings as above. ♂ forewing 26.5 mm.; ♀ forewing 27.0 mm. Types from Siberut (B.M. Types Rhop. Nos. 15023 and 15024).

It is curious that Fruhstorfer (1913, in Seitz, Grossschmett. Erde, ix. p. 604) makes no reference to the fact that this species can be separated readily from the similar *Neptis duryodana* (Mre.) by the absence of the whitish streak across the base of the cell on the underside of the

hindwing. In fact, *annamitica* Fruh., described from South Annam, is a race of *N. duryodana* and not of *N. magadha* (C. & R. Feld.), as Fruhstorfer supposed.

*Neptis duryodana paucalba* Hagen. Siberut, ♀ (♀); Sipora, 3 ♂♂, 9 ♀♀.

*Neptis nata taranda*, subsp. n. Siberut (♀).

♀.—Upperside resembles subsp. *agathyllis* Fruh, from West Sumatra, but the white markings are faintly tinged with blue and the white sagittate spot at the cell-end is separated from the white cell-streak. Underside slightly darker and more purple-brown, with the white markings narrower; the forewing cell-streak separated from the distal sagittate spot as above. Forewing 27.0 mm. (B.M. Type Rhop. No. 15025.)

*Neptis soma* (Mre.), subsp. Sipora, ♀.

Upperside rather similar to a female from Tenasserim in the British Museum, but the underside is greyish brown and not golden brown. It differs from subsp. *sumatrensis* van Eecke (1918, Zool. Meded. iv. p. 89, pl. viii., fig. 11), from the Padang Highlands, in that the white cell-end stripe on the forewing is distinctly separated from the triangular patch beyond. As the specimen is not in good condition, I am reluctant to describe it as new.

*Neptis hellodore siberuta*, subsp. n. Siberut, 2 ♂♂, 4 ♀♀ (♂); Sipora, 2 ♂♂; North Pagi Is. (♀).

♂.—Upperside differs from subsp. *niasana* Fruh., from Nias, in the narrower and almost obsolete orange submarginal line on the hindwing. Underside with the dark markings slightly broader than in *niasana*. Forewing 20.0 mm.

♀.—Upperside with the orange markings narrower than in *niasana*, particularly the narrow submarginal line on the hindwing. Underside with the dark markings blacker and slightly broader than in *niasana*. Forewing 22.5 mm. Types from Siberut (B.M. Types Rhop. Nos. 15020 and 15021).

*Neptis vikasi infusata* Hagen. Siberut, 3 ♂♂, 5 ♀♀ (♂); Sipora, 6 ♂♂, 7 ♀♀ (2 ♀♀).

Evans (1924, J. Bombay Nat. Hist. Soc. xxx. p. 78) separated *harita* Mre. and *vikasi* Hsf. as distinct species, but a study of the male genitalia and distribution of the

forms has shown that *harita* is a geographical race of the widely-distributed species *N. vikasi*.

***Neptis mlah karnyl***, subsp. n. Siberut (♀); Sipora, ♀.

♀.—Upperside with the orange markings slightly narrower than in subsp. *digitia* Fruh., from North Borneo, but more diffuse and slightly sullied. In the type from Siberut, the inner orange submarginal line on the hindwing is very narrow and edged with diffuse purple-grey on each side. Underside with the ground-colour darker and the markings narrower and without the extensive ochreous colouring found in *digitia*. Forewing 23.0 mm. (B.M. Type Rhop. No. 15022.)

***Parathyma kanwa euryleuca*** (Hagen). Sipora, ♂, ♀.

In *euryleuca*, the white streak in the cell of the forewing is entire and not divided, showing it to be a form of *P. kanwa* (Mre.), and not of *P. reta* (Mre.) as Fruhstorfer incorrectly supposed.

***Parathyma reta ramba***, subsp. n. Siberut, ♀; Sipora, 2 ♂♂ (♂); North Pagi Is., ♀.

A very distinct subspecies and nearest to subsp. *syma* (Fruh.), from Nias, with regard to wing-shape and the position of the markings.

♂.—Upperside of hindwing with the white median band nearly twice as broad as in *syma*, and posteriorly very convex. Underside darker brown, without the ochreous hue found in *syma* and with the white markings as above. Forewing 28.0 mm. Sipora (B.M. Type Rhop. No. 15027).

♀.—Upperside with the white markings (other than the hindwing post-discal band) distinctly broader than in *syma*. Forewing with the white subapical spots conjoined and an additional white spot in space 3 above the spot in space 2, but smaller. Hindwing white median band outwardly very convex. Underside darker brown without the ochreous hue of *syma*, and with the white markings as above. Forewing 32.0 mm. Siberut (B.M. Type Rhop. No. 15028).

***Parathyma nefte tigrina***, subsp. n. Siberut, 3 ♀♀; Sipora, ♂, 2 ♀♀.

♂.—Nearest to subsp. *nefte* (Cr.), from Java, but the hindwing tornus is rounded, and not produced as is usual

in the Javanese form. Upperside differs in that the white post-discal spot in space 2 on the forewing has its outer edge in line with the outer edge of the spot in space 1*b* and is not placed obliquely. On the hindwing, the white spot in space 7 is obsolete, and the white submarginal band increases only slightly towards the tornus. Underside dark greyish brown, lacking the ochreous hue of *nefte*: white markings as above, except that there is a small, white, diffuse spot in the centre of space 7. Forewing 27.0 mm.

♀.—Upperside as in ♀-f. *nefte* (Cr.), from Java, but the orange median band decreases in width towards the costa, the black basal band meeting the black post-discal band in space 7. Underside with the markings darker and blacker. Forewing 31.0 mm. Types from Sipora (B.M. Types Rhop. Nos. 490 and 491).

*Limenitis procris laubenheimeri* Hagen. Siberut, 3 ♀♀.

There can be no doubt that the Paramalayan forms placed under *L. æmonia* Weym. by Fruhstorfer (1913, in Seitz, Grossschmett. Erde, ix. p. 641) are conspecific with *L. procris* (Cr.), for there is no difference between the male genitalia of *L. procris minoë* Fruh., from Sumatra, and *imitata* Btlr. (= *æmonia* Weym.), from Nias.

*Limenitis procris minoë* Fruh. Padang, ♀.

**Pandita sinope confluens**, subsp. n. Siberut, ♂, ♀; Sipora, ♂, ♀; North Pagi Is., 2 ♂♂, ♀.

♂♀.—Nearest to subsp. *imitans* (Btlr.), from Nias, but the upperside of the forewing is much darker, particularly in the distal half, and the white median band is confluent and almost uniformly wide between veins 2 and 7. On the hindwing above, the orange-brown areas in the distal half are broader than in *imitans*, the blackish-brown bands being narrower. Underside of forewing with the area beyond the white band greyish brown, except for an orange-brown submarginal line and the dark purplish-white submarginal lines: forewing white median band as above. ♂ forewing 25.5 mm.; ♀ forewing 30.0 mm. Types from Siberut (B.M. Types Rhop. Nos. 492 and 493).

Examination of the male genitalia of *P. sinope sinoria* C. & R. Feld., from Borneo, and *imitans* (Btlr.), from Nias, has confirmed the conspecificity of these forms.



*Lobades martha distincta*, subsp. n. Siberut, ♀ (♀).

♀.—Differs from all known races of *L. martha* (F.) in the white quadrate spot in the forewing cell, situated about  $\frac{1}{2}$  of the length of the cell from the base, and the smaller, inwardly diffuse, white spot below it in space 2. On the upperside of the forewing the white spots forming the median band are arranged as in subsp. *alankara* (Hsf.), from Java; the white median band on the hindwing is broader, with the inner edges of the larger and darker post-discal crescentic spots only very narrowly pale-edged. The forewing white post-discal fascia is more pronounced than in *alankara*, and the hindwing white submarginal border is broader and composed of almost quadrate spots.

Underside with the ground-colour darker brown than in *alankara*, with the white markings mostly broader, and the two white subbasal spots on the forewing as above. Forewing 30.5 mm. (B.M. Type Rhop. No. 15029.)

*Tanaëcia pelea visandra*, subsp. n. Mentawi Is., ♂; Siberut, ♂ (♀); Sipora, ♀.

♂♀.—Differs from all known races of *T. pelea* (F.) in that the white post-discal fascia on the forewing above and the costal third of the hindwing is almost obsolete, being only faintly indicated by diffuse, dull, sullied white patches in the costal half of the forewing.

Upperside deep olive-brown, with the dark brown markings placed as usual (for instance, in subsp. *heliophila* Fruh., from Nias), but the forewing post-discal and submarginal spots (the latter not sagittate) are large and diffuse; the hindwing median series forms a continuation of the forewing post-discal series, and between this and the rather large and diffuse submarginal spots (which are not sagittate) is a series conjoined to form a narrow, dark, diffuse line.

Underside deep greenish brown, the forewing washed with purple in the male. The inner edge of the feebly indicated white fascia on the forewing is bounded by broad, diffuse, black spots; on both wings, the black diffuse submarginal spots are not sagittate and are placed nearer the wing-margins. On the hindwing, between the black cell-end strigæ and the post-discal row of black spots, is a further series of black spots, separated in the male and conjoined to form an irregular line in the female.

The palpi in both sexes and the male genitalia are exactly as in *T. pelea pelea* (F.) (vide Corbet, 1941, Ann. & Mag. Nat. Hist. (11) vii. p. 507, fig. 1 (♂ gen.), fig. 6a (palpi)).

♂ forewing 30.0 mm.; ♀ forewing 33.5 mm. Types from Siberut (B.M. Types Rhop. Nos. 15030 and 15031).

***Euthalia lepidea sipora***, subsp. n. Siberut, 2 ♀♀; Sipora, ♂, ♀.

♂♀.—Upperside differs from all described races in that the pale greyish-buff border on the forewing is broader and almost uniform in width to the apex: the hindwing border of the same colour, on which the darkened veins are visible, has the inner edge diffuse and more or less parallel to the termen, but narrowing towards the apex and tornus.

Underside much darker brown than in subsp. *flaminia* (Fruh.), from Tonkin, with the pale lavender border to both wings broader. A broad, diffuse, dark brown median band decreases from the forewing costa to the hindwing tornus. The female has small, diffuse, white post-discal spots in spaces 5 and 6 on the forewing, that in space 6 being the larger. ♂ forewing 30.0 mm.; ♀ forewing 33.0 mm. Types from Sipora (B.M. Types Rhop. Nos. 15033 and 15034).

Hitherto, *E. lepidea* (Btlr.) was not known south of the Malay Peninsula. Its occurrence in the Mentawi Islands is remarkable.

***Euthalia cocytna cocytna*** (Hsf.). Padang, 3 ♂♂, 2 ♀♀.

In both females, the upperside of the hindwing is less extensively washed with pale purple than in any examples in the long series in the British Museum.

***Euthalia aconthea purana*** Fruh. Padang, ♀.

***Euthalia alpheda kenodontus*** Fruh. Padang. 2 ♀♀.

***Euthalia anosia pagiana***, subsp. n. North Pagi Is., ♀.

♀.—Nearest to the Bornean subsp. *yapola* Fruh., but the upperside is much darker, the white post-discal fascia on the forewing is broader, and the pale bluish areas on both wings are more extensive. Underside darker than in *yapola*, with the forewing white post-discal fascia broader. Forewing 37.0 mm. (B.M. Type Rhop. No. 15032.)

**Eulaceura osteria barsena**, subsp. n. Siberut, 2 ♂♂ (♀).

♂.—Upperside differs from subsp. *nicomedeia* Fruh., from Sumatra, and subsp. *osteria* (Westw.), from Java, in the much darker ground-colour, in the much narrower sullied white median band on the forewing, and in the larger black submarginal spot in space 2 on the hindwing, which is ringed with purple-white. Underside with the ochreous markings in the races from Sumatra and Java replaced by brown, edged with ochreous, and the pupillate spots in space 2 on the forewing and hindwing are larger and more prominent. Forewing 3.0 mm.

♀.—Upperside nearest to subsp. *osteria* (Westw.), from Java, but the ground-colour is darker brown and the white fasciæ on both wings are more extensive, being a clearer white and faintly tinged with lavender. The black submarginal ocelli in space 2 on the forewing and hindwing are larger and more prominent. Underside with the ground-colour darker than in *osteria*, the inner edge of the broader white fasciæ more irregular, and the submarginal ocelli in space 2 on the forewing and hindwing larger and more prominent. Forewing 34.0 mm. (B.M. Types Rhop. Nos. 15035 and 15036.)

**Prothoë franck phameralls**, subsp. n. Siberut, ♂.

♂.—Upperside differs from all known Malaysian races of *P. franck* (Godt.) in the narrower forewing median band, in this respect being nearest to subsp. *borneensis* Fruh., from Borneo. The white fascia which forms the distal portion of the median band is placed as usual, but is much broader and whiter, and the proximal edge is bordered with purple-blue, although comparatively narrowly so. The forewing white apical spots are smaller than in *borneensis*. Underside darkened as in *borneensis*, but the dark brown areas are broken up into markings running parallel to the wing veins. On the forewing, an oblique white median band can be clearly seen, and the hindwing markings are bluish rather than golden green. Forewing 35.0 mm. (B.M. Type Rhop. No. 15037.)

**Polyura hebe quæsitæ**, subsp. n. Sipora, ♂.

♂.—Upperside differs from subsp. *fallacides* (Fruh.), from Nias, in that, on the forewing, the pale green subapical spot is larger and the black distal border broader.

The hindwing differs in the absence of a large black sub-apical patch, all the white lenticular submarginal spots being inwardly edged with black wedge-shaped marks (those in spaces 6 and 7 larger, lighter and diffuse). Under-side ground-colour rather darker and much blacker, lacking the ochreous hue found in *fallacides*. Forewing 32.0 mm. (B.M. Type Rhop. No. 15038.)

The only species of Nymphalidæ previously recorded from the Mentawi Islands, and not obtained during the 1924 expedition, is *Rhinopalpa polynice mentawica* Fruh., which was taken by Herr A. Maass in 1897 and reported by Hagen (1902, Abhandl. Senckenb. naturforsch. Ges. **xx**. (3) p. 334).

#### *The Distribution of Mentawi Butterflies.*

As the whole of the Raffles Museum collection of Mentawi Rhopalocera has now been worked out, a few words on the distribution of the species may not be out of place. Of the 186 species of butterflies known from the Mentawi Islands, 42 (22.6 per cent.) occur also in Ceylon, 134 (72.0 per cent.) in Burma, north of Mergui, 179 (96.2 per cent.) in Malaya, the same in Sumatra, 176 (94.6 per cent.) in Borneo, and 151 (81.2 per cent.) in Java. The figures show a much higher proportion of widely-distributed species than is the case with the Malayan Rhopalocera.

All the species common to the Mentawi Islands and Malaya are found in the Peninsula in primary forest at altitudes below 2500 feet, except *Vindula erota* (F.), *Euthalia lepidea* (Btlr.), *Jamides cyta* (Bsdv.) and *Kineta iadera* (Nic.), which are not usually taken below 2500 feet. *Hidari doescena* Mart., as yet unknown from Malaya, appears to be restricted to high altitudes in Sumatra and Borneo.

Apart from the two endemic species, *Eurema mentawiensis* Cbt. and *Elymnias nelsoni* Cbt., the most interesting butterfly in the Mentawi list is *Euthalia lepidea* (Btlr.), hitherto only known from the asiatic mainland.

Unlike the Malayan Rhopalocera, there was no relation between abundance and extra Mentawi distribution, the coefficient of abundance (Corbet, 1941, Proc. R. ent. Soc. Lond. (A) xvi. p. 107) for the species found from Ceylon to Java, for those occurring from Burma to Java, and for

those confined to Neomalaya (Malaya, Sumatra and Borneo) being 2.77, 2.80 and 2.83 respectively.

In all families, the sex ratio of the collected specimens was much higher than 1.0 (highest in Hesperiidæ, 3.34, and lowest in Pieridæ, 1.68), being 2.10 for the whole collection, of which 67.7 per cent. of the 2271 specimens were males. The sex ratio appeared to be unrelated to the relative abundance or extra Mentawi distribution of the species.

L.—*Descriptions and Records of Bees*.—CLXXXV.

By T. D. A. COCKERELL, University of Colorado.

*Steganomus acutiferus* Cockerell.

♂.—Kasindi, Beni, Belgian Congo, Aug. 1914 (J. Bequaert).

*Steganomus junodi* Gribodo.

♀.—N. E. Rhodesia; Niamadzi River, near Nawalia, 2,000 ft., Aug. 1910 (S. A. Neave).

*Nomia ferrugata* Cockerell.

♀.—Transvaal (A. J. Chalmley). Differs from the type by having first tergite mainly black, and stigma dusky red. With it, with the same data, comes a male *N. griseohirta* Cockerell. The types of *N. ferrugata* and *N. griseohirta* were taken at Ficksburg, O.F.S., and in spite of the different appearance, I am convinced that these are the sexes of one species.

*Nomia umbiloensis* Cockerell.

Described from Natal. A female from Durban, collected by F. Muir in 1902, agrees with what I have identified as female *N. umbiloensis*, but it comes with males of *N. fulvohirta* Smith, and looks as if it belonged with them. It agrees well enough with Smith's short description of female *N. fulvohirta*, except that the mandibles are not ferruginous at the base. My notes on the type female of *N. fulvohirta*, examined in The British Museum, appear to confirm this reference. However, *N. umbiloensis* was based on the male, which is structurally very different from *N. fulvohirta*. It is the supposed female of this species which must be transferred to *N. fulvohirta*. A

female of this supposed *N. umbiloensis* was taken by M. Bequaert at Lubumbashi, Katanga, March 12, 1921. At the same place, on the same day, M. Bequaert took two males of *N. fulvohirta* Sm.

The genuine *N. umbiloensis*, with tawny hair on face was described as a variety of *N. vulpina*, and this is apparently its true status. A male before me is from Sarnia, Natal, April 1, 1927 (Turner).

*Nomia ruwenzorica biconica*, subsp. n.

♂.—Face narrower ; scutellum with two very prominent conical elevations ; hind tibia more slender, their hair entirely pale, abdomen narrower.

Uganda : Ruwenzori, 8,000 ft., Feb. 17, 1912 (Capt. J. Fraser).

*Nomia chiromensis*, sp. n.

♂.—Length about 9 mm.

Almost exactly like *N. bequaertiella* Ckll., with the same broad orange bands on abdomen, but considerably larger, with paler wings, paler nervures, and a large and broad second submarginal cell ; anterior tibiæ in front and their tarsi pale red (in *bequaertiella* the anterior tibiæ are entirely black) ; face broader. Face densely covered with pale flavescent tomentum ; flagellum slender, black, with a red spot beneath at base ; hair of thorax above thin, pale fulvous ; first tergite with a band which fails in middle.

Nyasaland : Chiromo (R. C. Wood, 1978). This could be regarded as a race of *N. bequaertiella*, but the localities are far apart, and no intermediates are known.

*Nomia talodiana*, sp. n.

♂.—Length about 9 mm., anterior wing 7.5.

Robust, black, with broad, oval abdomen ; head broad, orbits converging below ; eyes black ; face and lower part of front densely covered with pale cinereous, faintly yellowish hair ; mandibles black ; tongue very short, maxillary palpi long ; antennæ not very long, but reaching to scutellum, black, the flagellum dusky reddish beneath ; scutellum unarmed, prominent but not bigibbous ; mesonotum and scutellum shining, not covered with hair ; postscutellum with dense pale tomentum ; metathorax hairy, the bare basal area triangular, with fine plicæ ; tegulæ not enlarged, dark, obscurely reddish ; wings dusky throughout, but not

clouded at tip ; stigma rather large, dusky red, nervures brown ; basal nervure bent only at lower end, falling a little short of nervulus ; second submarginal cell large and broad, receiving recurrent nervure beyond the middle ; legs basally black, the hind knees broadly red ; tibiae partly reddish, but densely covered with pale hair ; tarsi pale reddish ; hind legs hardly modified, the femora stout but simple, the tibiae broad apically ; abdomen with hind margins of tergites pale, covered with pale tomentum, the first tergite as well as the others with a band ; bands on third and fourth tergites fulvescent and conspicuously broadened in middle ; apical plate dusky red ; fifth sternite showing a pair of large black globose bilobed structures.

Sudan : Talodi, Aug. 15, 1929, from dura (*F. Whitfield*). Imp. Bur. coll. 11011. The general appearance is suggestive of the group of *N. aureovittata* Ckll., but the abdominal bands are different, and there is probably little affinity. At first sight I thought the specimen was a female, on account of the robust form and hairy legs. It runs out in my tables and that of Strand. It runs in Strand's table near *N. braunsiana* Friese, which is allied to *N. aureovittata*.

*Nomia bequaertiella*, sp. n.

♂.—Length about 6.7 mm., anterior wing 6.

Short and broad, looking like a female ; black, with very pale yellowish tarsi ; head broad ; face densely covered with slightly flavescent hair ; mandibles black ; antennae slender, only moderately long, flagellum red beneath apically, shading to black toward the base ; mesonotum and scutellum dull, the mesonotum with thin short fulvescent hair, the scutellum (which is prominent and obtusely bilobed) with much rather long pale fulvous hair ; meta-thorax posteriorly without evident hair, the basal area a channel which is glistening and irregularly wrinkled ; sides of thorax very hairy ; tegulae not enlarged, very dark reddish, anteriorly with a broad whitish margin ; wings dusky throughout, but with no distinct apical cloud ; stigma dull pale reddish, nervures brown ; basal nervure bent at lower end, meeting nervulus ; second submarginal cell large, about square, receiving recurrent nervure not far from end ; legs with abundant pale hair ; hind femora stout, with a small rudiment of a tooth on underside ; hind tibiae very broad, but otherwise simple ; abdomen

broad and short, shining, conspicuously punctured; first tergite with marginal hair-bands at sides only; second with an entire pale band in the apical depression, third and fourth with very broad pale ferruginous hair-bands, narrowed and pallid at sides.

Liberia: Du River, Camp No. 3, four specimens (*J. Bequaert*). Also taken at Kolobanu, Liberia.

Related to *N. talodiana* Ckll., with similar abdominal bands, but distinct by the hair on thorax above, the strongly reddish bands on tergites three and four, and the band-like area of metathorax. There is also a specimen from Gbanga, Liberia, in which the broad abdominal bands are white. Should this variation be confused with *N. talodiana*, it will be easily distinguished by the abundant long hair behind the scutellum.

*Nomia chlorozona* Cockerell.

Sierra Leone: Free Town, Sept. 6 (♀) and 21 (♂), 1899 (*E. E. Austen*).

The female is new. It will be known by the abundant pale fulvous hair on thorax above, with no black intermixed; the abdominal hair-bands, broader than in *N. viridicincta* Meade-Waldo, and the anterior spur of hind tibia abruptly bent at end. In these specimens the second submarginal cell is conspicuously higher than broad. The species was described from the Sudan.

*Nomia ruonis*, sp. n.

♂.—Length about 9.5 mm., anterior wing 7.5.

A species closely allied to *N. serratula* Smith, the hind margin of hind tibia strongly serrate. It differs from *N. serratula* (type examined in British Museum) by having the abdomen clear bright red, even to the base, and the very broad second submarginal cell (it is very high and narrow in type *N. serratula*), receiving the recurrent nervure not far from the end. Mandibles black; face densely covered with creamy-white hair; antennæ black, the flagellum faintly brownish beneath; mesonotum and scutellum shining between the strong punctures; there is a band of white hair along hind margin of mesonotum, conspicuous in lateral view, but invisible when seen from behind; scutellum strongly bigibbous; area of metathorax a rather narrow band, with strong cross-ridges; tegulæ not enlarged, hyaline with a brownish boss; wings dusky, stigma



and nervures brown, the stigma not very large; basal nervure bent at lower end, falling short of nervulus; hind femora robust, with a large sharp tooth on apical half beneath, and a small tooth beyond that; hind tibiæ pale red except at base and along hind margin; tarsi pale, the hind basitarsi pale reddish and very long.

Portuguese E. Africa: Ruo Valley, 2,000 ft., April 9, 1913 (S. A. Neave).

*Nomia mesopyrrha*, sp. n.

♀.—I had referred this to *N. vulpina* Gerst., but on close comparisons I can only conclude that it is distinct. The abdominal bands are much narrower, those on tergites 2 to 4 only about half as wide; the second tergite, which in *N. vulpina* is distinctly shining and punctured, is dull, with excessively minute dense punctures; the hind basitarsus is shorter than in *N. vulpina*; the hair on metathorax is comparatively short; the hair on mesonotum is pale greyish, but on scutellum and postscutellum it is fox-red, with no dark hairs intermixed; the tongue seems to be longer and more slender.

N. Rhodesia: Buyamungoma Boma, Jan. 14, 1911 (Silverlock).

This is also similar to *N. fulvohirta* Sm., from which it is known by the narrower bands, the brown (instead of light red) tegulæ, and the narrower face. The large second submarginal cell, with recurrent nervure joining it near its end, is as in *N. fulvohirta*. The first tergite is moderately shining on disc, but not polished. The flagellum is red beneath. In the dorsal pubescence it resembles *N. murinella* Ckll., but it is much larger. It is easily known from *N. natalensis* Ckll. by the small red stigma and pale veins, and the broader face.

On May 24, 1913, T. J. Anderson took a female in the Masai Reserve, British E. Africa, which differs so little from *N. mesopyrrha* that I cannot separate it as a species, though more material may indicate a distinct race. I give a description of this form:—

Length about 11 mm., anterior wing 8.2 mm.

Black, including legs, except that the tarsi are pale red apically, and the hind basitarsi are slightly brownish; face broad, with white hair, dense and snow-white at sides; mandibles black; antennæ short, the flagellum red beneath;

vertex dull; mesonotum dull, with rather thin pale grey hair; scutellum and postscutellum with bright ferruginous hair; area of metathorax inconspicuous; tegulae not enlarged, with a dark brown boss and pallid margin; wings dusky, but with no marked apical cloud; stigma very small, light red; nervures pale; basal nervure strongly arched, falling short of nervulus; second submarginal cell broad, receiving recurrent nervure near end; hind tibiae with a large pure white scape, but with black hair along upper margin; hind basitarsi short and very broad; abdomen with four white bands, covered with hair, not very broad; apex with black hair.

Three *N. mesopyrrha* were taken by Michael Bequaert at Lubumbashi, Katanga, April 8 and 11, 1921.

*Nomia rufotegulata*, sp. n.

♀.—Length about 11.5 mm., anterior wing about 8.

Robust, black with bright ferruginous tegulae, which are long-oval; mandibles black; face dull, with thin greyish-white hair; vertex dull; flagellum bright ferruginous beneath; mesonotum entirely dull, with thin short greyish hair; scutellum dull, not bigibbous; area of metathorax a narrow channel; metathorax not hairy behind; wings strongly dusky, but not clouded at apex; stigma rather large, dark brown; nervures brown; basal nervure arched at lower end, meeting nervulus; second submarginal cell higher than broad, receiving recurrent nervure beyond middle; legs dark brown, the hind femora reddish except at base; hind basitarsi broad; abdomen dull, without conspicuous bands, the apex with greyish hair, the vertex with short reddish hair.

E. Africa: 13 miles north of M'baboris Village, towards Meru, Feb. 13, 1911 (*T. J. Anderson*).

To be compared with such species as *N. rugicollis* Friese and *N. rothkirchi* Friese, but easily known by the red tegulae.

*Nomia ferripennis*, sp. n.

♂.—Length about 9 mm., anterior wing 7.4.

Black, with the tibiae and tarsi bright ferruginous; mandibles ferruginous, darkened apically; face broad, covered with white hair; antennae short for a male, the flagellum dusky reddish; vertex and mesonotum

dull ; scutellum bigibbous, faintly shining ; area of metathorax a narrow channel, distinctly shining ; hair of thorax above pale greyish, short and thin on mesonotum, at sides of thorax it is white ; tegulæ hyaline, with a pale yellowish boss ; wings strongly ferruginous ; stigma rather large, clear red ; nervures darkened ; basal nervure arched only at lower end, meeting or nearly meeting nervulus ; second submarginal cell very large and broad, receiving recurrent nervure not far from end ; hind femora swollen, with much long hair, the apical part slightly reddish ; abdomen very broad, with the transverse sulci deep ; first tergite shining and strongly punctured ; the first three tergites with rather narrow clear white bands, on first broadly failing in middle ; fourth and fifth with pale tegumentary bands, lacking the clear white hair ; apical plate broad and red, and apex with red hair.

Cape Province : Lady Grey, Feb. 2, 1925 (*R. J. Nel*).

Very distinct by the red wings, whereby, and by the much narrower abdominal bands, it is easily distinguished from *N. dominarum* Ckll. The dull mesonotum at once separates it from *N. fulvipes* Friese.

*Nomia mesridionlis abyssinica*, subsp. n.

♀.—Scutellum with no polished areas ; mesonotum and scutellum with an admixture of black hairs.

Abyssinia : Harrar, May, 1911 (*R. E. Turner*).

The following key separates some similar species :—

- |   |                             |
|---|-----------------------------|
| Abdominal bands pale grey ; hair of face white .....                    | 1.                          |
| Abdominal bands red .....   | 2.                          |
| 1. Scutellum with a pair of polished areas ....                         | <i>meridionalis</i> Friese. |
| Scutellum wholly dull, without polished areas .....                     | <i>abyssinica</i> Ckll.     |
| 2. Hind tarsi black ; male antennæ with a large black apical lobe ..... | <i>kinduna</i> Strand.      |
| Hind tarsi red .....  | 3.                          |
| 3. Hair of face pale golden .....                                       | <i>aureotecta</i> Ckll.     |
| Hair of face white .....  | <i>crawshayi</i> Ckll.      |

The wings of *N. abyssinica* are dusky at end, but not nearly so dark as in *N. aureotecta* and *N. crawshayi*.

*Crocisaspidia zonaria* (Walker).

Gold Coast : N. Territories, Yapi, Sept. 1916, male (*J. J. Simpson*).

LI.—*Descriptions and Records of Bees*.—CLXXXVI.

By T. D. A. COCKERELL, University of Colorado.

*Nomia femorata nyasicola*, subsp. n.

♀.—Friese described *N. femorata* from the male, but the females before me appear to belong to it. It must be said, however, that there is a related male from the same locality and date, which is at least subspecifically distinct from *N. femorata*, and these females may well belong to that subspecies. On the whole, it seems best to place these together, and regard the insect as a subspecies of *N. femorata* Friese, taking the male for the type.

♂.—Similar to *N. femorata*, but differing by the very long flagellum being clear red beneath; hair of mesonotum greyish; tergites with the rather broad apical depressions shining grey; hair of sixth tergite dense and black; legs brown; apical inner part of the broad hind tibia whitish; third sternite shining and with a pair of tubercles; stigma (as in the female) very pale testaceous; wings with no apical cloud.

Nyasaland: S.W. of Lake Chilwa, Jan. 12, 1914 (*S. A. Neave*).

This male may be compared with other species, as follows:—

Abdomen with broad bands of dense fulvescent tomentum on tergites 2 to 4.....	<i>emicata</i> Ckll.
Abdomen without such bands.....	1.
1. Hair of face long and loose, white.....	<i>viridarii</i> Ckll.
Hair of face flavescent, mainly short and dense, but partly long.....	<i>nyasicola</i> Ckll.

In a series of Nyasaland males, *nyasicola* is distinguished by the incrassate, toothed, hind femora, which are not partly yellow, and the very broad second submarginal cell. The female is distinguished by the red tegulæ, and cinereous hair of mesonotum.

*Nomia emicata* Cockerell.

♀.—Nyasaland: Mlanje, Feb. 8, 1913 (*S. A. Neave*). Described from Elizabethville, Katanga.

*Nomia dubitans* Cockerell.

Nyasaland: Mlanje, 1912, 1913 and 1914. Nine females (*S. A. Neave*). Described from the Belgian Congo.

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*Nomia rufonitens*, sp. n.

♀.—Length about 12 mm.

Black, with the first three tergites light ferruginous, each with a transverse black band, on first and second pointed at sides and not nearly reaching lateral margin, on third longer, and about as broad as the red hair before and behind it, and approaching, but not reaching, lateral margin; hair of thorax above thin and fulvescent; mesonotum dull, a little shining on disc, scutellum dull; wings dusky hyaline, faintly darker at apex; second submarginal cell higher than broad, receiving recurrent nervure beyond middle. Very close to *N. ferrugata* Ckll., but certainly distinct by the following characters:—hair of thorax above with no dark hairs intermixed; hair of scutellum much shorter; first three abdominal tergites shining; hair at apex of abdomen pale; hind tibiæ convex, sparsely hairy, with no distinct scopa; hind basitarsi shining; antennæ shorter.

Nyasaland: Mlanje, May 26, 1913 (*S. A. Neave*).

The reduction of the scopa suggests that this species may be parasitic or inquiline, but the classiform hind tibiæ do have a quantity of very long hair beneath.

*Nomia supratecta*, sp. n.

♂.—Length about 10·5 mm.

Black, the head and thorax densely covered with pale grey hair, on mesonotum forming a fine, slightly yellowish, tomentum, on scutellum with some long hairs; metathorax densely covered with tomentum, except the linear basal area; tongue long and slender, palpi small; face rather broad; antennæ black, not very long; ocelli close together and prominent; occipital region with long hair; tegulæ moderately large, light brown with a pale margin; wings long, hyaline, with the apical region broadly darkened; stigma small, dusky reddish; nervures dark brown; basal nervure meeting nervulus; second submarginal cell higher than long, recurrent nervure joining its apical corner; legs black, covered with grey hair, apical joint of tarsi red; hind legs slender and simple, the femora red beneath apically; abdomen covered with tomentum, which is thin at bases of tergites 2 to 4, but is dense and pale orange on apical part of tergites, forming very broad bands; tergites beyond fourth con-

cealed, the abdomen apically truncate and trilobed, with much long black hair; the median spine-like structure really consists of two spines; sternites 1 to 5 unmodified, with pale margins.

British E. Africa: Masai Reserve, April 20, 1913 (*T. J. Anderson*).

Closely allied to *N. pertecta* Ckll., and perhaps to be regarded as a subspecies. It has a similarly modified abdomen, but with the bands orange or clay-colour instead of white, and the tomentum of thorax above cinereous rather than reddish.

*Nomia elephas* Strand.

Nyasaland. Females show some variation, as follows:—

- |  |   |
|--|---|
| Smaller, anterior wing about 7.5 mm. ....        | S.W. of Lake Chilwa,<br>Jan. 16, 1914 ( <i>S. A. Neave</i> ). |
| Larger, anterior wing over 8 mm. ....            | 1.  |
| 1. Base of second tergite broadly dull red. .... | W. Nyasa District ( <i>H. Silberrad</i> ).                    |
| Base of second tergite black. ....               | Mlanje, April 14 and<br>17 ( <i>S. A. Neave</i> ).            |

Neave also took three males at Mlanje, October, March and April.

*Nomia fulvohirta* Smith.

Katanga: Lubumbashi, March 12, 1921, two males (*M. Bequaert*).

These agree with a Togo male received from Friese, except that the second submarginal cell is much larger. Smith described the species from a female taken by the Rev. D. F. Morgan. The male hind femora are slender and simple. I also have *N. fulvohirta* from Nyasaland, Mlanje (*Neave*), S. Rhodesia, Salisbury, Oct., 1899, male (*G. A. K. Marshall*), Lonely Mine, Dec. and Jan., both sexes (*H. Swale*), and from Durban, Natal, 1902 (*F. Muir*). *N. claripes* Cockerell, from Natal, is the same species.

*Nomia panganina* Strand.

British E. Africa: Masai Reserve, April 19, 1913 (*Anderson*); Mt. Ruwenzori, 1400 ft., June 5, 1914. Belgian Congo: Kabango, 1000 m., Dec. 4, 1914 (*Bequaert*).

These differ from Strand's description by having the hair on inner side of tarsi white, but the agreement is otherwise so close that I do not venture to separate our

bee. In my table of males with simple hind legs it falls near *N. brunnipes* Ckll., being easily separated by the large tegulæ.

*Nomia rubella mutopicola* Cockerell.

Portuguese E. Africa : Chibababa, Lower Buzi River, Dec., 1906, male (*C. F. M. Surynnerton*).

*Nomia bevisiana* Cockerell.

Pondoland : Port St. John, male (*Turner*).

*Nomia brunnipes*, sp. n.

♂. Length about 6 mm., anterior wing 5.5.

Black, with the tarsi pale brown, the hind basitarsi whitish at base ; mandibles obscurely reddened apically ; face rather narrow, orbits converging below ; clypeus distinctly produced (compare *N. gratiosa* Strand), face densely covered with white hair, which also extends up the front ; antennæ long, reaching postscutellum, the flagellum dusky red beneath ; mesonotum polished, thinly hairy ; scutellum exposed, shining, obtusely bigibbous ; postscutellum with pale tomentum ; metathorax thinly but evidently hairy, the basal area broadly triangular, dull except apically ; tegulæ small, very dark brown ; wings long, dusky hyaline ; stigma large, pale fulvous, nervures pale, the marginal nervure darkened ; basal nervure arched ; second submarginal cell narrow, receiving recurrent nervure near the base ; hind femora stout but simple ; hind tibiæ thickened apically, with a strong dentiform projection on inner side near apex ; abdomen shining, the sutures impressed, the margins of tergites pallid, with pale hair-bands, on first two tergites only distinct at sides ; apex of third sternite broadly pallid ; fourth sternite covered with fine pale tomentum, and its hind margin with a pair of small protuberances.

Zululand : Eshowe, May 1-3, 1926 (*R. E. Turner*).

Runs in Strand's table to *N. atripes* Friese, which has the wings strongly brown, first recurrent nervure going to apical corner of second submarginal cell, and stigma very small. The shining mesonotum distinguishes it from various superficially similar small species.

*Nomia angustula*, sp. n.

♂.—A small species with narrow clavate abdomen and slender hind legs, in nearly all respects like *N. kamerunensis* Friese, but with the disc of mesonotum and the scutellum polished, and the fourth abdominal sternite covered with pale reddish tomentum, the area so covered bounded by a thickened margin. The mesonotum has a very slender median groove, but not the impressed lines of *N. kamerunensis lineata*. The tarsi are dark, as in *N. ethioparca* Ckll. ; the hind tibia has the inner angle distinctly before the apex ; the long flagellum is dusky red beneath, the stigma is dark reddish, and the small polished tegulæ are wholly dark.

Belgian Congo : Congo de Lemba, Jan.-Feb. 1913 (*R. Mayné*). Congo Museum.

*Nomia kamerunensis* Friese.

Gold Coast : Aburi, 1912-13 (*W. H. Patterson*) ; Liberia : Bakratown, Ibang and Du River, Camp No. 3 (*J. Bequaert*).

*Nomia kamerunensis lineata*, subsp. n.

♂.—Differs from *N. kamerunensis* by having three shining impressed lines on disc of mesonotum anteriorly. Herein it resembles the South African *N. trilineata* Ckll., and *N. albidula* Friese.

Uganda : Kampala, Nov. 17, 1915 (*G. C. C. Gowdey*), Feb. 6, 1927 (*G. L. R. Hancock*) ; Kololo Kampala, Nov. 1926 (*Hancock*).

It is possible that *N. k. lineata* is a distinct species, and it may be referable to one of the similar species at present known only from the female. A male collected by Michael Bequaert at Lubumbashi, Katanga, Feb. 8, 1921, was at first set aside on account of the dull mesonotum, but I consider it to be *N. k. lineata*.

*Nomia innesi* Gribodo.

Sudan : G. R. F. Medani, on berseem (*F. G. S. Whitfield*).

*Nomia megalepis* Cockerell.

S. Africa : Lady Grey, ♀ (*Nel*).

*Nomia crawshayi* Cockerell.

S. Rhodesia : Lonely Mine, Feb. 25, 1915 (*H. Swale*).



*Nomia politibasis*, sp. n.

♂.—Length about 7 mm., anterior wing about 5.5 (6 in Uganda specimen).

Black, with the tarsi very pale, reddish, the basitarsi white; mandibles black; face rather narrow, densely covered with white hair, which extends up front to level of antennæ; flagellum moderately long, very faintly reddish beneath; mesonotum dull, a little glistening on disc, with very thin pale hair, much denser at sides; scutellum slightly bigibbous, distinctly tomentose, much as postscutellum; metathorax hoary behind with white hair, the basal area small, finely lineolate; tegulæ rather elongate, pale testaceous, with a dark boss in front; wings long and ample, hyaline, with no apical cloud; stigma large, pale fulvous; nervures very pale; basal nervure arched, meeting nervulus; second submarginal cell very broad, receiving recurrent nervure beyond middle; legs slender, the hind tarsi long, hind tibiæ pale at extreme base and apex; abdomen long-oval, shining, the first two tergites conspicuously polished, the apical depressions of tergites pale, with bands of pale hair, the first tergite with hair only at sides; venter with pale bands.

Zululand: Eshowe (type-locality), March 23–31, 1926 (R. E. Turner). Uganda: Kampala, July 19, 1926 (R. H.).

This widely-distributed species could be taken for *N. hylæoides* Gerst., but the polished basal part of abdomen and the broader first tergite readily separate it. The shorter antennæ and very pale nervures separate it from *N. junodiella* Friese. The tomentose hind part of metathorax suggests affinity with *N. leucomelanura* Ckll., *N. perornata* Ckll., and *N. somereni* Ckll., but these are otherwise very different. The shining base of abdomen suggests *N. lucidula* Vachel, which has dark tegulæ.

*Nomia scitula* Bingham.

N. Rhodesia: Sinapunga, Feb. 13, 1911, male (*Silverlock*). Nyasaland: S.W. of Lake Chilwa, Jan. 12, 1914 (*Neave*); Port Herald, wet season (*Dr. J. E. S. Old*).

*Nomia cryptodonta rufotibialis*, subsp. n.

Hind tibiæ clear red.

Liberia: males from Lenga Town (type-locality), Aug. 15, Memeh Town, Aug. 29, and Kakatown, Aug. 20.

Female from Lenga Town, Aug. 15. All taken by Dr. J. Bequaert.

The female of *N. cryptodonta* has not been described. It appears to be a species which Friese named in manuscript, the name referring to the three broad bands of the abdomen. The female has the hind basitarsi broadly black at end, and the broad second joint is black. The basitarsi is very much smaller than in *N. perornata* Ckll., and differently shaped, being parallel-sided, a little broadest at end.

*Nomia delagoana* Cockerell.

♀.—W. Africa : F. Smith collection, Sept. 7, 1922 (British Museum). Previously known from the other side of Africa. Nyasaland : Port Herald, Apl.—June, 1913 (*Dr. J. E. S. Old*).

*Nomia pulchella* Friese (*pulcherrima* Friese).

S. Africa : Aliwal North, Okahandja and Queenstown ; all taken by Turner.

*Nomia trilineata* Cockerell.

S. Africa : Port St. John, May, 1924 (*Turner*).

*Nomia silverlocki*, sp. n.

♂.—(Type). Length about 12.5 mm., anterior wing 9.5.

Black, with the hind femora and tibiæ light yellow, but the hind tarsi dark, except the base of the basitarsi ; tongue slender, not very long ; mandibles black ; face rather narrow, densely covered with pale, slightly flavescent hair, with some darker hairs intermixed ; antennæ long and slender, the flagellum red beneath ; vertex dull ; thorax thickly clothed with pale fulvescent hair, a little darker dorsally, dense on scutellum and metathorax except the triangular enclosure ; tegulæ pale testaceous, not enlarged ; wings dusky hyaline, conspicuously darkened apically ; stigma small, dusky reddish, nervures brown ; basal nervure falling a little short of nervulus ; second submarginal cell small, higher than long, receiving recurrent nervure about the middle ; legs mainly dark brown, but hind femora and tibiæ yellow, the femora considerably swollen, the tibiæ with an obtusely angular subapical projection on inner side ; abdomen with broad orange bands of dense short hair, the first tergite broad, densely

covered with pale hair, but the apical band very narrow ; venter with white hair.

♀.—Length about 11.5 mm.

Antennæ long and slender for a female ; face not very broad ; hind femora and tibiæ yellow, but the knees dark ; abdomen with broad creamy-white tegumentary bands on tergites 2 to 4, and a narrow ill-defined band on first ; hair at end of abdomen black. The second sub-marginal cell shows that this cannot be the female of *N. scitula* Bingham, which also occurs in N. Rhodesia.

N. Rhodesia : male from road to Nangareri, Feb. 6, 1911 (*Silverlock*). Two females from Algoa, May 3, 1910 (*Silverlock*).

Closely related to *N. crawshayi* Ckll., so much so that I had regarded it as a race of that species, but the genitalia are different, with extremely broad stipites, and elongated sagittæ. The metathorax agrees with *N. crawshayi*, not at all with *N. aureotecta* Ckll. Another related species is *N. speciosa* Friese, with larger tegulæ. *N. perornata* Ckll. is considerably smaller, with no light band on first tergite, and a shorter marginal cell.

*Nomia aureotecta* Cockerell.

Natal : Van Reenen, Drakensberg, Dec. 1926 ♀ (*R. E. Turner*).

*Nomia viridarii* Cockerell.

Natal : Van Reenen, Drakensberg, Nov., Dec. 1926, both sexes (*R. E. Turner*).

*Nomia epileuca* Cockerell.

This was described (1939) from the female taken at Seeheim. At Okahandja, S.W. Africa, in February, Turner took a female *N. epileuca* and seven males, which I think must belong to the same species, in spite of their clear hyaline wings. They have the following outstanding characters : face and front densely covered with pure white hair ; mesonotum appearing grey, from a thin clothing of white hair, but scutellum with pale fulvous hair, contrasting ; legs with much white hair, hind femora robust, tibiæ and tarsi dark, not yellow or red ; abdomen with five white bands, the first tergite with a band ; first four sternites covered with white hair. The tegulæ are pale rufotestaceous. Length about 9 mm., *N. whiteana* Cameron differs by the fulvous hair of head and thorax.

LII.—*Spolia Mentawiensis* : *Rhopalocera*, Hesperiidæ.

By W. H. EVANS.

THE following list of the Hesperiidæ, obtained by Messrs. C. Boden Kloss and N. Smedley in the Mentawi Islands (Siberut, Sipora and North Pagi Island), in the Batu Islands (Pulau Tello) and at Padang, West Sumatra, in October, 1924, is arranged in accordance with the author's 'Identification of Indian Butterflies' (2nd ed., 1932), as modified by minor subsequent changes introduced in papers in the 'Entomologist' and the 'Journal of F.M.S. Museums.' The Director of the Raffles Museum, Singapore, has generously consented to the retention by the British Museum of all types and such material as may be considered essential for the National Collection.

1. *Hasora badra badra* Moore. ♀, Siberut ; ♀ Sipora.
2. *Hasora khoda minsona* Swin. ♂, Siberut.
3. *Hasora schönherr* Lat. ♂, Sipora.
4. *Bibasis harisa moncada* Fruh. ♀, Padang.
5. *Capila phanæus quagga*, nov. ♂, Siberut : type B.M. Resembles *phanæus*, except that it is darker on both sides ; dark spots on hindwing underside much more prominent ; hyaline apical spots on forewing complete and prominent. 2 ♂♂, Siberut ; 2 ♂♂, Sipora.
6. *Charmion ficulnea queda* Plötz. ♀, Sipora.
7. *Tagiades gana narba*, nov. ♂, Batu Islands (Pulau Tello) : type B.M., based on a specimen not obtained on the present expedition. Resembles *gana*, except that the tornal white area on the hindwing upperside is half as wide, while on the underside the brown apical area is continued broadly but tapering nearly to the dorsum. In the ♀ the cilia only are white. 2 ♀♀, Siberut ; 2 ♂♂, ♀, Sipora ; ♂, Pulau Tello.
8. *Tagiades japetus utanus* Plötz. ♂, Siberut ; 4 ♂♂, ♀, Sipora.
9. *Odontoptilum pygela pygela* Hew. 2 ♂♂, Sipora.
10. *Iambrix stellifer* Butl. 2 ♂♂, 2 ♀♀, Siberut ; 6 ♂♂, 3 ♀♀, Sipora ; ♂, North Pagi Is.
11. *Iambrix sindu* Feld. ♂, Padang.

12. *Iambrix distant* Shepard (= *unicolor* Dist., præoco.).  
♂, 2 ♀♀, Siberut ; 5 ♂♂, 3 ♀♀, Sipora.
13. *Koruthaialos xanites xanites* Butl. 18 ♂♂, 3 ♀♀,  
Siberut.
14. *Koruthaialos xanites rudra*, nov. ♂, Sipora : type  
B.M. Exactly resembles *xanites* but the red band on  
the forewing upperside is abbreviated, not extending  
below vein 2. On the underside the band is narrower  
and dorsally macular. In the female, the red band  
is narrower and on the underside it is tapered tornally.  
2 ♂♂, ♀, Sipora.
15. *Koruthaialos butleri sumatrana* Evans. ♂, Siberut ;  
33 ♂♂, 8 ♀♀, Sipora.
16. *Sancus pulligo pulligo* Mab. ♂, ♀, Siberut ; 3 ♂♂, ♀,  
Sipora.
17. *Kerana nigrita nigrita* Lat. 3 ♂♂, 3 ♀♀, Siberut ;  
24 ♂♂, 5 ♀♀, Sipora ; ♂, North Pagi Is.
18. *Kerana armatus armatus* Druce. 6 ♂♂, ♀, Siberut ;  
19 ♂♂, ♀, Sipora.
19. *Kerana gemmifer* Butl. 9 ♂♂, ♀, Siberut ; 8 ♂♂, ♀,  
Sipora.
20. *Udaspes folus* Cram. ♀, Padang.
21. *Notocrypta devadatta xantha*, nov. ♀, Siberut ;  
type B.M. This species was treated incorrectly in  
Ident. Ind. Butt. (1932, 2nd ed.), p. 371, as *volux* Mab.  
(see Corbet, 1938, J. F. M. S. Mus. xviii. p. 259).  
*Xantha* resembles a normal female of *devadatta*, but  
the forewing band is pale yellow instead of white  
and the lower part of the palpi below as well as the  
cheeks (part of head between eyes, palpi and thorax)  
is also yellow ; the usual pale dot in space 4 is  
present. Forewing length 23 mm. Type unique.
22. *Notocrypta paralysos nitron*, nov. ♂, Sipora : type  
B.M. *Paralysos* remains the oldest name for the  
species treated as such in Ident. Ind. Butt. (1932,  
2nd ed.), p. 371 : *volux* is considered to be the oldest  
name for the form flying throughout Malaysia,  
except that *varians* Plötz, *sidha* Fruh., and *clavata*  
Stgr. are taken to be somewhat different representa-  
tives on Nias, Java and Palawan respectively. *Nitron*

is very similar to *sidha* and *clavata*, but the forewing white band is more irregular and attenuated towards the costa; there is no spot in space 4. Forewing length 19 mm. ♂, 3 ♀♀, Siberut; 3 ♂♂, 2 ♀♀, Sipora.

23. *Notocrypta curvifascia fraga* Fruh. ♂, Sipora.
24. *Erionota acroleuca apex* Semp. ♂, Sipora; ♂, Pulau Tello; ♂, Padang.
25. *Hyarotis adrastus meluchus* Fruh. ♀, Sumatra.
26. *Hyarotis adrastus armax*, nov. ♂, Sipora: type B.M. Only differs from the mainland form in the reduction of the spotting on the forewing; apical spots and spot in space 3 are absent. Type unique.
27. *Hyarotis monteithi monteithi* W. M. & De Nic. ♂, ♀, Siberut.
28. *Kineta iadera iadera* De Nic. ♂, ♀, Siberut.
29. *Iema protoclea* H. S. 2 ♂♂, Siberut; ♂, ♀, North Pagi Is.; ♂, Padang.
30. *Sepa-miosticta* De Nic. ♂, ♀, Sipora.
31. *Sepa umbrosa umbrosa* El. & Edw. ♀, Siberut; ♀, Sipora. Spotting somewhat reduced.
32. *Plastingia latoia latoia* Hew. 2 ♂♂, ♀, Siberut.
33. *Plastingia pugnans* De Nic. ♂, Siberut; ♂, 2 ♀♀, Sipora.
34. *Lotongus excellens* Stgr. ♀, Sipora.
35. *Zela zeus zeus* De Nic. ♀, Siberut.
36. *Zea mythecha mythecha* Hew. ♂, Siberut.
37. *Unkana ambasa attina* Hew. ♀, Sipora; ♀, Padang.
38. *Hidari doescæna* Martin. ♂, Sipora.
39. *Pirdana distanti pavona* De Nic. ♂, Sipora.
40. *Cupitha purreea purreea* Moore. ♀, Sipora.
41. *Taractrocera ziclea trishna* Fruh. 60 ♂♂, 2 ♀♀, Siberut; ♂, ♀, Sipora; 2 ♂♂, ♀, North Pagi Is.; 6 ♂♂, Padang.
42. *Potanthus archias alma* Evans. 25 ♂♂, ♀, Siberut; 21 ♂♂, 10 ♀♀, Sipora; 7 ♂♂, North Pagi Is.; 3 ♂♂, Padang.

43. *Potanthus serina serina* Plötz. 2 ♀♀, Sipora ; ♀, North Pagi Is.
44. *Cephrenes chrysozona niasica* Plötz. 2 ♂♂, Sipora ; ♂, Padang.
45. *Baoris cormasa* Hew. ♀, Siberut ; ♀, Sipora.
46. *Pelopidas agna* Moore. 8 ♂♂, 5 ♀♀, Siberut ; ♀, Sipora.
47. *Pelopidas cinnara* Wallace. 2 ♀♀, Siberut ; ♀, Pulau Tello ; ♀, Padang.
48. *Pelopidas guttatus apostata* Snellen. ♀, Siberut.

LIII.—*A new Species of Ischnura (Order Odonata); A Dragon-fly Nymph, possibly Agriocnemis Selys, and other records from Tahiti* \*. By EDWARD PHILPOT MUMFORD, Stanford University.

IN an earlier paper on the collections of the Pacific Entomological Survey, Professor J. C. Needham (1932) lists eleven species of dragon-fly from Tahiti. Two of these, *Ischnura cardinalis* Kimmins, and *I. taitensis* Selys †, are as yet unknown elsewhere. Of the other nine, one is known to range across the Pacific from New Britain to

\* *Studies on Faunal Distribution* No. 3.—These studies of faunal distribution, initiated by Mr. E. P. Mumford at Oxford, under my general direction, at the expense of funds received through the Higher Studies Fund at Oxford, the Royal Society, the British Museum (Natural History), the British Association for the Advancement of Science, and various subscribers to the Oxford University Chest, have, since the war, received further generous support from the Carnegie Corporation of New York, the National Academy of Sciences, the Society of Sigma Xi, the American Association for the Advancement of Science, the American Philosophical Society, and the May Esther Bedford Fund, Inc. Grateful acknowledgement is here made, on behalf of Mr. Mumford and myself, to all of these organizations, and especially to the Officers and Trustees of Stanford University, where the work is now being carried on, as well as to the Hawaiian institutions ('Nature,' vol. cxxx. No. 3291, pp. 797-798 and 803, Nov., 26, 1932), which enabled Mr. Mumford to visit the Marquesas and Tahiti. A note on the Pacific Entomological Survey, of which Mr. Mumford was Director, was published in 'Nature,' vol. cxli. p. 196, Jan., 1938. See also Mumford and Adamson (1933) and Mumford (1936 and 1940, a and b). The Pacific Entomological Survey publications were concluded in 1939.—G. D. Hale Carpenter, Hope Professor of Zoology (Entomology), University Museum, Oxford.

† Needham (1932) states that Selys "recorded two species of *Ischnura*," but one of these, *delicata* Selys, from "Taiti" and Bora Bora in the Society Islands, is now known to be a synonym of the widely-distributed wind-carried *aurora* Brauer.

the Marquesas, four \* are Austromalayan, two are from the old-world tropics, one is Australian, and another is circum-tropical. To these records can now be added that of a new species of *Ischnura* and a nymph, possibly belonging to the genus *Agriocnemis* Selys, hitherto unknown from Polynesia east of Samoa. This genus is represented there by three species:—the unique male, *interrupta* Fraser, the largest species of the genus yet discovered; *vitiensis* Tillyard, ranging through the New Hebrides and Fiji; and *exudans* Selys, extending from New Caledonia and the New Hebrides.

Of interest to the student of faunal distribution is the possibility of such an eastward extension to Tahiti of the known range of *Agriocnemis*, the occurrence there of three apparently peculiar species of the cosmopolitan genus *Ischnura* Charpentier, and also the description from Tahiti of *Hemicordulia oceanica* Selys, in 1871. According to Fraser (1927), this archaic genus, *Hemicordulia*, which occurs also in the Marquesas (Mumford, 1942), may well have originated in the ancient submerged western Pacific continent.

The description of the nymph, possibly *Agriocnemis*, is based upon the specimen collected by Professor A. M. Adamson, formerly of the Pacific Entomological Survey. It was taken at an altitude of about 1400 feet in Lake Vaihiria, Tahiti, on November 1, 1928.

Grateful acknowledgement is here made to Professor Needham for the description, as well as to Lieutenant-Colonel F. C. Fraser, Mr. D. E. Kimmins, Professor Clarence H. Kennedy and Professor G. D. Hale Carpenter for assistance in the preparation of this paper.

"The nymph is not fully grown (length 9, plus gills 4 mm.). It is pale with a faint pattern of light brown, and with hair-lines of darker colour on the rear of the head and on the spinulose carinæ of body and legs. It is very like the nymph of *A. lacteola*, described and figured by me in my 'Manual of the Dragon-flies of China,' page 255, pl. xviii. fig. 3. The dark subapical bands on the femora are faint. There is no pattern on the gills but the faintly purplish tracheæ in them show through the transparent skin. The mental setæ are three each side, and the laterals four" (Needham).

\* Needham (1932), by typographical error, refers to one of these as *Diplacodes trivialis* (Fabricius) instead of *Diplacodes trivialis* Rambou.



The description and figures of the following species have been communicated to me by Lt.-Col. F. C. Fraser :—

*Ischnura cheesmani*, sp. nov.

*Male*.—Abdomen 23 mm. Hindwing 16 mm.

Head : labium pale yellow ; labrum, genæ, frons and epistome pale greenish yellow, the latter traversed from side to side by a broad black stripe ; rest of head black with two large, nearly rounded sky-blue postocular spots. Prothorax black, the sides low down and a small spot at each postero-lateral angle pale blue. Posterior lobe rounded, slightly elevated. Thorax black on dorsum, pale blue on the sides, but this changing to greenish yellow low down and ventrally ; the dorsum bearing two narrow blue antehumeral stripes which are expanded somewhat

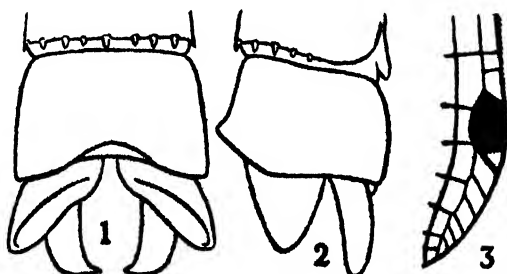


Fig. 1.—Anal appendages of *Ischnura cheesmani*, sp. nov., dorsal view.

Fig. 2.—The same in right profile view.

Fig. 3.—Pterostigma of forewing.

below ; laterally a small black point on the upper part of the first lateral suture and an irregular narrow black stripe on the second suture. Legs yellow, the femora black on the extensor surface, the tibiæ black on the flexor surface. Wings hyaline, 10 postnodals to forewings, 9 to the hind ; pterostigma of forewing resembling that of *Ischnura senegalensis*, acutely pointed distally, this side and the posterior one forming a single convexity ; proximal side very short : black, with the distal angle pale bluish. Pterostigma of hindwing only half the size, lozenge-shaped, greyish yellow, framed in black nervures. Abdomen black on dorsum, greenish yellow laterally and beneath from segments 1 to 7. Segments 8 to 10 steely blue metallic. The black on dorsum of segments 3 to 7

expanding apically and forming complete black narrow annules apically. Anal appendages: superiors black, as long as segment 10, broad at base, tapering to apex and bevelled from within outwards: subtriangular as seen in profile. Inferior appendages nearly twice as long as superiors, black at base, bluish white thereafter, broad at base, tapering to the apex, which is sharply turned inwards and ends in an acute point. Seen in profile, these appendages are obtusely unguulate and slope slightly downwards.

*Habitat*: TAHITI: Hitiaa. A single male collected by Miss L. E. Cheesman, from whom this new species receives its name; collected 10. vii. 1925.

*Type* in the Morton collection, Royal Scottish Museum. This new species is easily distinguished from *I. taitensis* Selys, by the presence of a lateral black stripe on thorax, and from *I. cardinalis* Kimm., by the colour of the pterostigma.

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#### LIV.—Description of a new Terrestrial Isopod from Natal.

By WALTER E. COLLINGE, D.Sc.

IN 1910\* I recorded a species of Terrestrial Isopoda from Natal which I referred to *Porcellionides pruinosus* (Brandt). I then stated that there were "many slight differences in these specimens from the typical *P. pruinosus*" and "further material may show greater differences."

\* Ann. Natal Mus., 1920, iv. p. 479, pl. xix. figs. 39-47.

I have recently received further material, and after careful examination and comparison with specimens of *P. pruinosis* from a wide series of localities, I am now of opinion that the specimens from Natal must be separated from *P. pruinosis* and referred to a new species which is here described.

*Porcellionides bagnalli*, sp. n.

Body oblong, dorsal surface slightly convex and almost smooth. Cephalon dorsally convex with the frontal margin obtusely pointed in the median line, lateral lobes very small and sharply pointed; posterior margin almost semicircular. Eyes large, antero-lateral. Antennulæ small, three jointed, with the distal one setose terminally. Antennæ shorter than in *P. pruinosis*. The two joints of the flagellum are almost equal in length, the proximal joint being only very slightly longer than the distal one. The outer lobe of the 1st maxilla has ten spines, of which the six inner ones are bifid terminally. Inner lobe distally truncate. Second maxillæ wider and more robust than in *P. pruinosis*, as also the maxillipedes. Telson somewhat elongated, extending beyond the basiopodites of the uropoda. Uropoda with exopodite more than twice as long as the small endopodite.

Length 9 mm.

Colour (in alcohol) of the dorsal surface dark brown with very fine yellow mottling.

*Habitat*.—Near Pietermaritzburg, Natal. Type in author's collection.

The previous specimens which I examined were from Pietermaritzburg and Durban, and are now in the Collection of the Natal Museum.

I have pleasure in associating with this species the name of Dr. R. S. Bagnall, to whom I am indebted for many interesting collections of Terrestrial Isopoda.

While allied to *P. pruinosis*, in many features *P. bagnalli* is a more robust species and is separated from that species particularly in the shape of the cephalon, the antennæ, the mouth parts and the form of the telson and uropoda.



1.

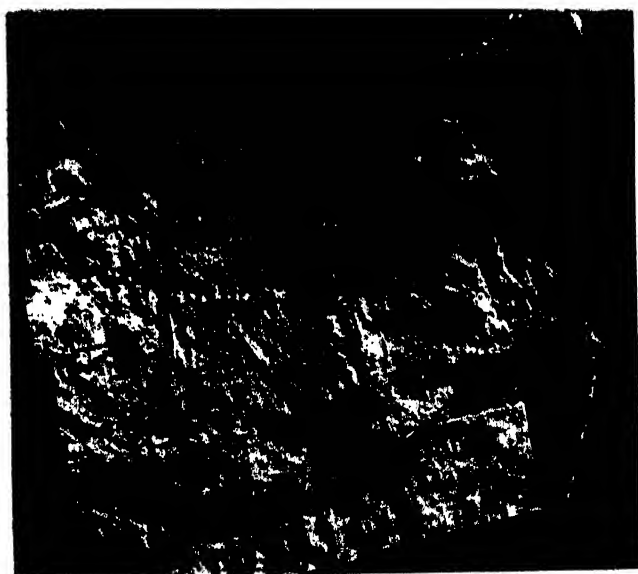


2.

**Hajula, Mt. Lebanon.**



1.



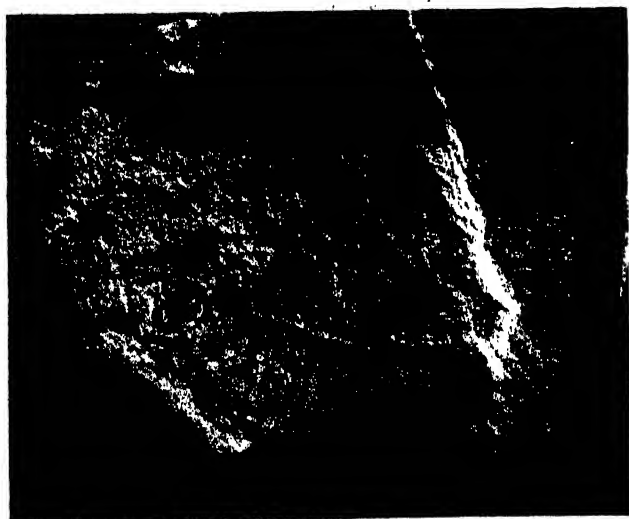
2.

1. Hoplopteryx.

2. Acrogaster.



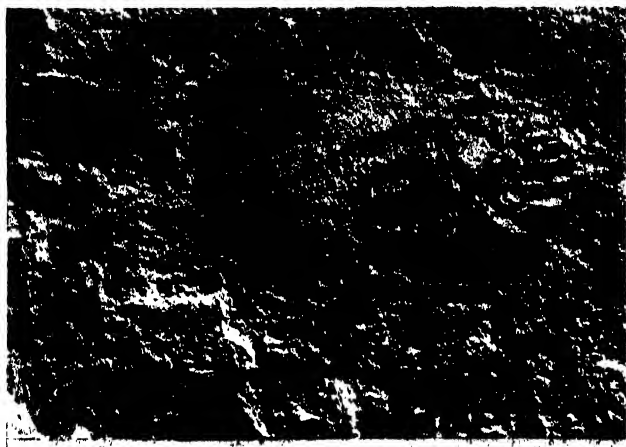
1.



2.

1. *Pycnosteroides*.

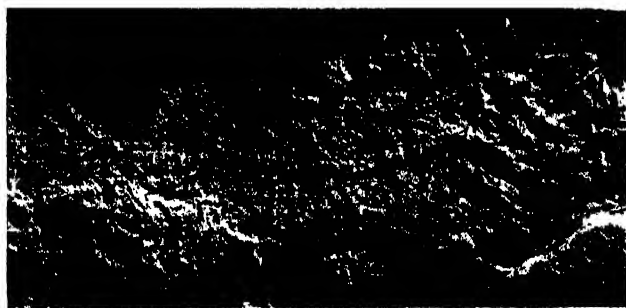
2. *Pharmacichthys*.



1.



2.



3.

1. *Protobrama*.

2. *Cœlorhynchus*.

3. *Hajulla*.



1.



2.

1. *Angullavus*.

2. *Cyclobatis*.





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LV.—*Some new Carboniferous Trilobites.*

By F. R. C. REED, Sc.D., F.G.S.

[Plates VIII.—XI.]

## INTRODUCTION.

THE two Carboniferous genera *Phillipsia* and *Griffithides* which Portlock instituted (1843, pp. 305, 310) have been made to include a somewhat heterogeneous assemblage of trilobites, and the names have been generally so loosely applied as to render their limits quite indefinite. Weller (1936) has therefore attempted to restrict their application and has re-defined their characters in the case of American species, thus necessitating the erection of several new genera for those species which he considers do not conform to either of these old-established genera. Undoubtedly Woodward (1883-4) used the names *Phillipsia* and *Griffithides* in too wide a sense, and he has been almost universally followed. Even Weber (1932-7) has not discarded that practice, though he has recognised the existence of several groups of species and given to one group of *Griffithides* the subgeneric name *Cyphinium* (1933), based on certain cranial characters, but Weller (1935-6) and Wang (1936) consider this subgenus to be synonymous with *Ditomopyge* Newell (1931), which according to Weller was founded on a pygidium of an

immature individual. The latter author subsequently traced the successive stages of its development, and stated that the cranidia of *Cyphinium* and *Ditomopyge* when adult were identical. This, however, is a disputed point. The genotype of *Ditomopyge* is *D. lansingensis* Newell (1931, p. 268, pl. xxxi. figs. 31, 32). The subgenotype of *Cyphinium* chosen by Weber (1933, pp. 45, 81) is *Phillipsia scitula* Meek and Worthen, 1865. But Weber (1937) is doubtful of their generic identity, and no young pygidia of any species of *Cyphinium* with the forked border of *Ditomopyge* have so far been recognised.

The following notes on a few interesting specimens in Mr. James L. Begg's collection are preliminary to a full revision of the British Carboniferous trilobites which is being undertaken. A restricted use of the generic names of *Phillipsia* and *Griffithides*, though not entirely as Weller (1936, pp. 704, 706) suggested, is here provisionally adopted, but since some of the species described below fit neither into them nor into any of Weller's new American genera, it has been necessary to establish some new generic groups.

Though not regarded as satisfactory in relation to British species, Weller's definition of *Phillipsia*, taking *Asaphus gemmuliferus* Phillips (1836, p. 240, pl. xxii. fig. 11) as the genotype, may here be quoted (1936, p. 704):—"Cephalon with flat marginal band [=pre-glabellar area] anterior to glabella. Glabella not expanded in front, sides nearly parallel and straight, widest posteriorly at the basal lobes. Basal furrows strongly curved. Eyes relatively small. Thorax with nine segments. Flange [=limb] of pygidium not well defined, segmentation of pleural lobes extending nearly to margin. Axis of pygidium low, nearly uniformly arched transversely." This definition is scarcely applicable to or complete enough for all the British species. It is noticeable that Weller does not show any "flat marginal band" in his outline figure of the head-shield (1937, p. 339, fig. 1).

His definition of *Griffithides* (1936, p. 706), taking *G. longiceps* Portlock (1843, p. 310, pl. xi. figs. 7a) as the genotype\*, is as follows:—"Cephalon without marginal

\* Weller's outline figure of the head-shield of *Griffithides* (1937, p. 339, fig. 1) depicts a glabella with a median constriction and lateral furrows, neither of which are present in the genotype or in other British examples of the genus (Woodward, 1883, p. 38, pl. vi. figs. 7, 8).

band [=pre-glabellar area] anterior to glabella. Glabella expanded in front. Basal furrows not strongly curved. Eyes comparatively small. Thorax with nine segments. Flange [=limb] of pygidium not well defined, segmentation of pleuræ extending faintly nearly to margin. Axis of pygidium low, nearly uniformly arched transversely. Axial segments 13 to 16; pleural segments 10 to 12." Further, he states that *Griffithides* may be distinguished from the new American genera, named (1936) by him *Paladin*, *Kaskia*, *Sevillia* and *Ameura*, and from *Ditomopyge* Newell, by the following combination of characters:— "absence of flat anterior cephalic margin, comparatively small eyes which are covered by palpebral lobes, and lack of well defined unsegmented pygidial flange [=limb]." His definition, however, would not completely apply to all the usually recognised British members of this genus. We must also note that while Woodward (1883, p. 27) says that the glabella of *Griffithides* is "destitute of lateral furrows," with which statement Toumanský (1935) agrees, Weller (1936, p. 705) declares that "lateral furrows are at least faintly present on almost all well preserved specimens," though he admits that their strength varies. Weber (1933) had previously stated that one or two pairs of lateral furrows may be faintly present or that all may be absent. These supposed differences seem due to the inclusion of species belonging to other genera or to the appearance of internal casts.

In establishing the following new genera described below, importance has been attached to the characters of the pygidium as well as to those of the head-shield, but in combination, though previously it has been the general custom (except by Weller) to ignore those of the pygidium and to group all the British species together in the genera *Griffithides* or *Phillipsia* irrespective of differences in this member. Thus in typical *Phillipsia* the limb of the pygidium has the same slope as the pleural lobes, whereas in *Griffithides* it is usually flattened or concave and turned up as Portlock stated (1843, p. 311). The course of the facial sutures has also not been sufficiently valued, and the fact that internal casts and more or less decorticated specimens of head-shields and pygidia have frequently been described or figured without sufficient reference to their condition, has led to misinterpretation of the

characters of the glabella and especially of the limb of the pygidium and other parts of that member. The genus *Brachymetopus* has, however, always been kept apart from these two genera since its foundation by McCoy in 1847.

## I. DEFINITION OF NEW GENERA.

### Genus CYPHINIOIDES, nov.

Glabella pyriform, reaching anterior margin of head-shield covering frontal border, and having small sub-triangular basal lobes, a depressed transverse pre-occipital lobe and two pairs of short lateral furrows, the posterior pair uniting across glabella. Eyes large, reniform. Facial sutures arched out anteriorly away from sides of glabella in semi-circular curve. Thorax of nine segments; pleuræ strongly geniculated and with rounded extremities. Pygidium semi-elliptical; axis prominent, semi-cylindrical, rounded, composed of about 15 rings; pleural lobes of about ten slightly convex pleuræ, dying out before nearly reaching margin of pygidium. Limb narrow, concave, undefined, slightly upturned.

Genotype: *Cyphinioides ashfellensis*, sp. nov.

### Genus EOCYPHINIUM, nov.

Head-shield strongly convex transversely. Glabella large, slightly constricted across middle, widest at base with anterior portion swollen, rounded, projecting beyond cheeks, completely or partly covering narrow rounded frontal border; basal lobes small, sub-triangular, projecting somewhat laterally and connected by a weak, broad transverse furrow across neck of glabella between their anterior ends, thus indistinctly marking off a slightly elevated pre-occipital lobe; two pairs of short lateral furrows also present. Facial sutures with anterior branches arching strongly outwards. Free cheeks swollen, bearing small reniform eyes; lateral border very narrow, rounded, elevated, thick, separated off by wide, shallow smooth groove. Surface of head-shield very coarsely tuberculated. Thorax and pygidium? unknown.

Genotype: *Eocyphinium clitheroense*, sp. nov.

## Genus WEBERIDES, nov.

Head-shield semi-circular to semi-elliptical. Glabella pyriform, more or less swollen, nearly or quite reaching but not overlapping narrow rounded frontal border; basal lobes small, triangular, often nearly obsolete; very short lateral furrows rarely present. Facial sutures with anterior branches curving strongly outwards. Free cheeks with long genal spines; lateral border wide, with bevelled edge; marginal furrow shallow; eyes large. Thorax of nine segments; pleuræ rounded, with fine pleural furrow. Pygidium semi-elliptical, semi-oval, or semi-parabolic in shape; occasionally pointed or mucronate; axis long, semi-cylindrical or trapezoidal, slowly tapering to blunt end, composed of 15-18 rings, each usually with tuberculated posterior edge. Pleural lobes gently convex, composed of 10-12 more or less rounded or flattened pleuræ ending abruptly at the inner edge of the limb, except the first 2-3, which may invade it and bifurcate at their ends; the pleuræ usually having a thickened posterior truncated edge bearing on its crest a row of small tubercles. Limb smooth or finely granulated, gently convex, usually wide and often widening posteriorly, occasionally mucronate, more or less sharply marked off from pleural lobes by marginal furrow (which may be absent) but always less steeply inclined.

Genotype: *Phillipsia mucronata* McCoy.

## Genus CUMMINGELLA, nov.

Head-shield semi-circular to semi-elliptical. Glabella sub-quadrate to sub-oblong, slightly constricted across middle, not much swollen; basal lobes sub-circular to sub-quadrate; two or three pairs of lateral furrows; frontal border of head-shield covered or overlapped by anterior end of glabella. Facial sutures following outline of glabella in close proximity to it, very slightly arched outwards. Free cheeks with large eyes occupying most of their surface; lateral border convex, narrow, marked off by fine shallow marginal furrow. Genal angles sub-rectangular or bearing short spines. Thorax of nine segments; pleuræ strongly and suddenly bent down at about half their length. Pygidium semi-circular; axis broad, about

one-third the width of the pygidium, convex, conical or with very gently arched sides, tapering to blunt tip, composed of 12-14 rings; pleural lobes convex, composed of 7-9 rather prominent gently rounded usually furrowed pleuræ ending abruptly at marginal furrow separating off limb, except the first two or three which may invade and partly cross the limb. Limb flattened or gently convex, of uniform width, horizontal or less steeply inclined than pleural lobes, and sharply marked off from them by marginal furrow.

Genotype: *Entomolithus (Oniscites) derbiensis* Martin.

## II. DESCRIPTION OF SPECIES.

Genus CYPHINIOIDES, nov.

*Cyphinioides ashfellensis*, gen. et sp. nov.

(Pl. VIII. figs. 1, 1 a, 2.)

Head-shield semi-elliptical. Glabella pyriform, gently convex, widening and slightly inflated anteriorly, with broadly rounded front end reaching margin of head-shield and completely covering the thick concentrically striated border with vertical anterior face; basal lobes elongated, pyriform, swollen posteriorly, acutely pointed anteriorly, about one-third the length of glabella and each about one-fourth its basal width, the basal furrows defining them very oblique and strong; base of neck of glabella cut off by weak, transverse, nearly straight furrow extending between basal lobes, thus forming a slightly depressed transversely oblong preoccipital lobe; two pairs of short lateral furrows present, the posterior pair longer, oblique and defining small indistinct subnodular lateral lobes feebly connected across glabella to form a narrow ring, the anterior pair of furrows consisting only of small transverse pits indenting sides of glabella. Surface of glabella covered with small pits and more or less fused minute granules arranged in lines, more or less distinctly concentric to outline of frontal lobe. Neck-ring broad. Cheeks triangular, longer than wide, convex, with large reniform eyes situated close to glabella and more than one-third its length; lateral border of cheeks convex, broad, not sharply marked off, bearing fine concentric striæ; doublure thick, rounded and covered with stronger concentric striæ.

Facial sutures bending out in front of eyes in wide semi-circular curve before sweeping inwards towards front of glabella. Thorax of nine segments; axis convex, semi-cylindrical, the annulations bearing a median row of small tubercles; pleuræ strongly geniculated, bent back at half their length and having their extremities rounded and curved slightly forward, each pleura bearing a median row of small tubercles. Pygidium broadly semi-elliptical; axis prominent, convex, semi-cylindrical, narrow, tapering very slowly, composed of +10 rounded rings, each bearing a median row of about six small equidistant tubercles; pleural lobes with inner half nearly horizontal and outer half gently arched down and passing into limb, composed of +8 slightly convex pleuræ nearly reaching edge of pygidium, but gradually dying out on the limb; limb narrow, undefined, concave, slightly bent up, with narrow rounded rim; doublure convex, concentrically striated. Surface of pygidium very finely granulated.

*Dimensions.*—

(No. B.G. 7853.)

	mm.
Length of head-shield .....	c. 9
Width of head-shield .....	c. 16
Length of thorax .....	c. 11
Length of pygidium .....	c. 8
Width of pygidium .....	c. 12

*Horizon and Locality.*—Lower Carboniferous (Ashfell Limestone), near Kirkby Stephen, Yorks.

*Remarks.*—This new genus and species is represented by one complete individual with the head-shield folded over and appressed against the pygidium, together with the somewhat broken and distorted thorax. The base of the head-shield and genal angles are broken; the right cheek and the left half and posterior end of the pygidium are crushed and imperfect, so that the precise number of its segments cannot be determined, but apparently only four or five are missing.

As regards its affinities, the head-shield and glabella much resemble *Griffithides* (*Cyphinium*) *alapaicus* Weber (1937, pp. 79, 138, t. x. figs. 23–25), from the Carboniferous of the Urals; the pygidium agrees in the pleuræ extending over much of the concave indefinite limb, but the axis in that species is said to be trapezoidal in cross-section and the pleuræ sub-triangular, though in the



Turkestan examples they are said to be rounded. The narrow weak ring on the glabella in front of the pre-occipital lobe in our specimen is another feature distinguishing it. The American species *Griffithides parvulus* (irty (1915, p. 268, pl. xviii. figs. 14, 15), which Weller (1936, p. 711) puts in *Ditomopyge*, has a head-shield with many similar characters. The pygidium in the Ashfell species is quite different to that of the genotype of *Ditomopyge*, which has a well-defined smooth limb sharply marked off from the pleural lobes and pleuræ, and the course of the facial sutures is another distinction. Owing to these important differences between this species and the genotype of *Ditomopyge* and all the described species of *Cyphinium*, especially in the case of the pygidium, we must put it in a new genus, for which the name *Cyphinioides* is proposed. It may be noted that the head-shield of *Pseudophillipsia sumatrensis* (Roemer) (Palæontographica, xxvii. 1880. p. 10, t. iii. fig. 7) bears a considerable resemblance, while its pygidium is like that of many species of *Cyphinium*, except in the possession of more numerous segments.

#### Genus EOCYPHINIUM, nov.

*Eocyphinium clitheroense*, gen. et sp. nov.

(Pl. IX. figs. 1, 1 a.)

Head-shield sub-parabolic in outline, nearly as long as wide, slightly arched down in front, strongly convex from side to side, the cheeks steeply arched down. Glabella slightly swollen and expanded in front half, somewhat constricted a little behind middle length, broadest at base, anterior end rounded and projecting beyond cheeks but not quite reaching edge of head-shield, a deep furrow marking it off from the narrow, thick, convex and grooved frontal border: basal lobes subtriangular, small, swollen, slightly projecting laterally, in length about one-sixth length of glabella and one-fourth its basal width, marked off by strong deep furrows curving back to meet neck-furrow at right angles; two pairs of very short lateral furrows present, the posterior pair strong and oblique marking off on each side a small, very narrow lateral lobe close to anterior end of basal lobes and mainly composed

of 2-3 fused tubercles; anterior pair of lateral furrows being only represented by small, short transverse pits just behind the middle constriction of glabella; a weak but rather broad slightly arched groove or gap interrupting the tubercular ornamentation crosses the base of the central lobe of the glabella and connects the anterior ends of the basal lobes marking off a slightly swollen, narrow vestigial preoccipital lobe. Surface of glabella minutely granulose and covered with coarse, round tubercles set at mostly their own diameter apart, but in no definite order except for the 5-6 which form a line along the neck-furrow. Fixed cheeks and palpebral lobes very narrow. Facial sutures with anterior branch curving strongly outwards before cutting front margin, the posterior branch bending sharply outwards behind eye so as to cut the posterior edge of the head-shield at an acute angle at the slight geniculation of the occipital segment. Neck-ring very wide, flattened, tuberculate. Free cheeks sub-triangular, longer than wide, convex, arching down steeply on each side in their outer two-thirds, bearing rather small reniform elevated eyes about one-third the length of the cheeks and situated close to the glabella at less than half its length. Surface of free cheeks covered with coarse tubercles like those on glabella but more widely spaced and roughly arranged in lines concentric to lateral margin of head-shield. Genal angles sub-rectangular, armed with very short small points. Lateral border of cheeks formed by a broad, smooth, concave band having a narrow raised rim with a thick, deeply-grooved vertical outer face. Occipital furrow deep, marking off narrow rounded occipital segment bearing a few tubercles, and rather suddenly slightly bent back and down at one-third its length from the side of the glabella.

*Dimensions.*—

(No. B.G. 8602.)

	mm.
Length of head-shield .....	12.0
Width of head-shield .....	15.0
Length of glabella .....	10.0
Width of glabella at front.....	7.0
Width of glabella at base .....	3.5

*Horizon and Locality.*—Lower Carboniferous, Clitheroe, Lancs.

*Remarks.*—The above-described new genus and species is founded on one well-preserved head-shield with the surface and test unworn and perfect except for a small portion of the upper surface of the anterior end of the glabella and the visual surface of the eyes and neck-ring.

With regard to its affinities, the Russian species *Griffithides spinosus* Weber (1937, pp. 71, 136, t. viii. figs. 16–19), from the Carboniferous of the Urals possesses nearly the same shaped glabella (so far as it is preserved) and similarly well-defined basal lobes, together, as Weber mentions, with a “vestige of a preoccipital lobe,” which is important, and “the probable presence of lateral furrows,” as well as a similar coarse tuberculation. The head-shield of the Turkestan trilobite which Weber named *Phillipsia bitumulata* (1932, pp. 46, 125, t. iv. figs. 1–15, text-fig. 12), has many of these characters and may be also allied to our species. The slight marginal geniculation of the occipital segment in our specimen is like that in *Gr. (Cyphinium) alapaicus* Weber (1937, pp. 79, 138, t. ix. figs. 23–25), and the trace of a preoccipital lobe, though it is only shown in our specimen by a transverse gap in the tuberculation in front of a slight basal swelling of the neck of the glabella, also suggests that subgenus or genus. But in the general character of the head-shield and shape and furrows of the glabella (apart from the incipient preoccipital lobe), as well as in the coarse tuberculation of the glabella and cheeks, we are reminded of *Griffithides seminiferus* (Phillips) (Woodward, 1883, p. 28, pl. v. fig. 14; Weber, 1937, p. 73, t. viii. figs. 26–29, t. xi. fig. 13), which, however, is not congeneric and must also be removed from *Griffithides*.

It is probable that the species from the Upper Carboniferous of Silesia, described by Roemer (1870, p. 79, t. viii. figs. 24, 25), and Schwarzbach (1935, p. 435, t. xxvii. figs. 6–9) as *Phillipsia margaritifera*, is a species with somewhat close affinities.

If we adopt either Woodward's or Weller's definition of *Griffithides*, the fact that the glabella in our new species has a marginal furrow and border in front of it, as well as a slight transverse constriction and the possession of a weak pre-occipital lobe and lateral furrows, separates it from that genus. The shape of the glabella and its other characters prevent us putting it either in the genus

*Cyphinium* or in *Cyphinioides*, but because of its possession of only an incipient pre-occipital lobe we may give it the new generic name *Eocyphinium* and associate it generically with the above-mentioned species *Gr. spinosus* Weber.

We may note that Parkinson (Q. J. G. S., vol. lxxxii. 1926), in his paper on the "Faunal Succession in the Carboniferous Limestones at Clitheroe and Pendle Hill, Lancs.," records the trilobites *Griffithides globiceps* and *Phillipsia gemmulifera* from the Salt Hill Knoll Series, but the present author has not seen his specimens, and to neither of these species can this Clitheroe specimen be referred.

*Eocyphinium? bivium*, sp. nov. (Pl. IX. figs. 2, 2 a, 2 b.)

Pygidium nearly as long as wide, sublanceolate, bluntly pointed behind, sides gently arched. Axis long, prominent, tapering very slowly to blunt truncated tip, subtrapezoidal in cross-section, having steeply sloping sides and somewhat broad flattened top, composed of 16-18 rings bearing small tubercles on their surface and having small nodular lateral swellings alongside the axial furrows. Pleural lobes with inner two-thirds flat and nearly horizontal, but outer third arched down rather steeply to limb; pleuræ rounded, simple, unfurrowed, the first 3-4 pleuræ having bifurcated ends, the anterior branch of which is prolonged on to the limb as a narrow transverse short ridge nearly reaching the margin of the pygidium, the posterior pleuræ having traces of similar but nearly detached ends on the limb; interpleural furrows strong, ending abruptly at marginal furrow. Limb depressed, gently convex, nearly horizontal, distinctly marked off from pleural lobes.

*Dimensions.*—

(No. B.G. 9089.) (No. B.G. 9082.)

	mm.
Length of pygidium .....	8.5
Width of pygidium .....	9.0
Width of axis at front end .....	3.0

*Horizon and Locality.*—Upper Carboniferous Limestone Group (Calmy Limestone), Linn Spout, Dalry, Ayrshire.

*Remarks.*—This species, which is only represented in Mr. Begg's Collection by the interior of a nearly perfect

and complete pygidium (No. 9089), and by the internal cast (No. 9082) of the same specimen, has somewhat peculiar features, and its generic reference is uncertain. The distinct and slightly convex limb, which is clearly marked off from the pleural lobes and has a different inclination, but especially the presence of more or less detached ends of most of the pleuræ crossing it, resemble the illustration and description of the pygidium of the Russian species *Griffithides spinosus* Weber (1937, pp. 71, 136, t. viii. figs. 16, 19), the reference of which to the genus *Griffithides* was doubted by Weber. The resemblance of the head-shields of that species and of that of *Eocyphinium clitheroense* above-described, has been already pointed out, and we may add that, apart from the presence of an incipient pre-occipital lobe on the glabella, the Australian species described by Mitchell as *Phillipsia collinsi* Mitchell (1918, p. 444, pl. xlv. figs. 1, 2; pl. xlviii. fig. 8) has a very similar glabella, while in the pygidium of that species (1918, pl. xlv. figs. 3-5) the shape, cross-section and number of segments in the axis, as well as the crossing of the limb by the ends of the pleuræ, appear to indicate a close affinity. In this extension of the pleural ends on to the limb, the Russian species *Ph. kirgisica* (Weber, 1932, pp. 44, 124, t. iii. figs. 38-50; 1937, pp. 51, 150, t. v. figs. 42-46, text-fig. 44) from Turkestan bears a great resemblance, but the pygidium has a different shape and the axis is not trapezoidal in cross-section.

On the strength of the resemblance of this Dalry specimen to the pygidium of *Gr. spinosus* we may refer it to the genus *Eocyphinium* with some confidence.

#### Genus WEBERIDES, nov.

*Weberides mucronatus* (McCoy), var. nov. *traquairi*.  
(Pl. XI. figs. 1-4.)

Head-shield semi-circular, with narrow rounded border in front of glabella. Glabella composed of (1) a pyriform median lobe moderately convex, more or less swollen posteriorly towards narrow neck, slightly indented on each side at anterior end of eyes, covered with small closely-set round tuberoles, and (2) a pair of small elongated, acutely triangular basal lobes, each as wide as the neck and

strongly marked off from it by oblique furrows. Facial sutures with anterior branches curving semi-circularly outwards in front of eyes; posterior branches short, divergent, cutting posterior edge of head-shield at an acute angle. Neck-ring with small median tubercle. Free cheeks sub-triangular, granulose, with rather long genal spines curving slightly inwards; lateral border with bevelled edge, doublure rather wide, gently convex, concentrically striated; eyes lunate, large, elevated, extending nearly half the length of the glabella; palpebral lobes semi-circular, projecting and upturned. Pygidium semi-oval to semi-elliptical, armed posteriorly with short pointed mucro. Axis long, conical, prominent, convex, not excavated or flattened at sides, less than one-third width of pygidium at front end, tapering gradually to tip, composed of 16-17 rounded annulations bearing small transverse tubercles on or near their posterior edge. Pleural lobes with inner half nearly horizontal, outer half arched down, composed of 9-10 rather flattened finely granulated pleuræ with steeply truncated and angulated posterior edge bearing line of granules. Limb depressed, smooth, rather wide, nearly horizontal, slightly convex, not sharply marked off from pleural lobes, without any strong marginal furrow, having a narrow bevelled edge concentrically striated; mucro short, acutely pointed, arising rather abruptly from limb; doublure convex, wide, concentrically striated.

*Dimensions.*—

(No. B.M. 104.)

	mm.
Length of head-shield .....	8.00
Width of head-shield .....	12.00
Length of glabella .....	6.75
Width of glabella in front .....	5.00
Width of glabella across basal lobes ..	4.25

(No. B.M. 102.)

	mm.
Length of pygidium (without mucro)	8.00
Width of pygidium at front .....	8.00

(No. B.M. 103.)

Length of pygidium with mucro ....	10.00
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*Horizon and Locality.*—Shale in Lower Carboniferous Series. Garple Burn, Muirkirk, Ayrshire.

*Remarks.*—This type of pygidium agrees with one figured by Woodward (1883, pl. iv. fig. 12), from the same horizon and locality as referable to *Phillipsia eichwaldi* (Fischer) var. *mucronata* McCoy, but it is not precisely identical with McCoy's *Ph. mucronata* (1844, p. 162, pl. iv. fig. 5), judging from his figure and description, nor identical with *Gr. mucronatus* Girty, 1910, which Weller (1936, p. 707) puts in his genus *Paladin*, though the genotype seems to possess many features in common. But Traquair's Scotch specimens (1869, pp. 213–218, pl. xvi. figs. 1–7), which he ascribed to McCoy's species and put in the genus *Griffithides*, appear to be identical with the variety above described, though not belonging to Portlock's genus of that name or strictly agreeing with McCoy's species. Woodward (1883, p. 23, pl. iv. figs. 1, 3, 12, 15) figured these and similar specimens from Scotch localities under the name *Ph. eichwaldi* var. *mucronata*. Klebelsberg (1912, p. 516, t. xxiii. fig. 14) and Schwarzbach (1935, p. 432, t. xxvii. fig. 1) would restore McCoy's *Phillipsia mucronata* to specific rank, but would keep it in that same genus. The free cheek from the Fourth Limestone, Dalry, figured by Woodward (1883, pl. iv. fig. 11) as *Ph. eichwaldi*, also possesses characters apparently indistinguishable from that of the head-shield No. 104 in Mr. Begg's collection, on which the above description is based, the peculiarities of the cephalic border being well shown.

There has been much confusion and uncertainty about the species "*Asaphus*" *eichwaldi* (Fischer), as Traquair (1869, p. 213), Woodward (1883, pp. 22–25), Mitchell (1918, pp. 440, 451, 477) and Weber (1937, pp. 63, 64, 134) have observed, no general agreement as to its character and synonymy existing amongst palæontologists. Much latitude in the application of the specific name has been common. Bell (1929, p. 186, pl. xxxv. figs. 3–6) would even include the Canadian species *Ph. howi* Billings in it. We may observe that Fischer and Eichwald founded it on a pygidium, and the head-shield was first described by Woodward. The generic reference of the species has also varied, and Weber (1937) was uncertain whether to place it in *Phillipsia* or *Griffithides*, but neither of these genera can strictly be regarded as containing it, nor can any of Weller's new American Carboniferous genera be made to include it satisfactorily, so that the new generic name *Weberides* is proposed for this and allied species in honour

of the Russian palaeontologist, who has done so much work in describing the many Carboniferous trilobites of that country, In many respects it considerably resembles *Gr. lutugini* Weber (1937, p. 74, t. viii. figs. 32, 33) and also his *Ph. eichwaldi* var. *mucronata* (1937, t. vii. figs. 20, 23 b), and to a less extent *Ph. cœlata* McCoy (1844, p. 161, pl. iv. fig. 4), which Woodward (1883, p. 22) put as a synonym of *Ph. eichwaldi*. But the nearest British ally of our new variety is *Griffithides shunnerensis* King (1914, p. 390, pl. xxxii.) from the Millstone Grit of Yorkshire; its head-shield and glabella have the same essential characters, though the basal lobes are less developed; the pygidium, however, is slightly different and has no mucro, but this may not be considered an essential generic feature any more than in *Dalmanites*. Weber (1933, pp. 33, 77), indeed, stated that this Yorkshire species showed the greatest resemblance to the above-quoted *Gr. lutugini*, and that the American form *Ph. sangamonensis* Meek and Worthen (Girty, 1915, p. 265, pl. xviii. figs. 10-13) was allied, but Weller (1936, p. 713) put the last-mentioned species as the type of his new genus *Ameura*, remarking that *Ph. eichwaldi* was suggestive of that genus, while he regarded *Gr. lutugini* and *Gr. transilis* Weber (1933, pp. 37-41, t. ii. figs. 17-22, text-fig. 19) as species resembling his genera *Kaskia* and *Paladin* (1936, pp. 707-8).

The type of McCoy's *Phillipsia mucronata*, which came from the Carboniferous Limestone of Ireland (1844, p. 162, pl. iv. fig. 5), has not been examined by the present author, and the figure and description in which he states that the pygidium is smooth and ends in a "short mucronate obtuse (not acute) point," are not sufficient to define the species, but we may follow the accepted interpretation of its characters given by Woodward and lately by Schwarzbach. Weber (1937, pp. 64, 134, t. vii. figs. 18-24) refers certain Russian specimens with a query to *Ph. eichwaldi* var. *mucronata* McCoy, which seem to be almost indistinguishable from our Muirkirk form.

*Weberides mucronatus* (McCoy) var. nov. *lata*.  
(Pl. XI. figs. 5, 5 a.)

This variety, which is founded on a pygidium (B.G. 7851) from Leslie, Fife, is distinguished from the variety *tra-*



*quairi* by its broader and more semi-circular outline, its narrower limb and more rapidly tapering axis, which has rather fewer rings. The first two or three pleuræ are also produced across the limb, with their ends bifurcated by the oblique extension of the angulation formed by the steeply truncated posterior edge so as to divide their tip into a larger anterior and a narrower depressed smaller posterior half. In other respects the pygidium is like the var. *traquairi*, the ornamentation being apparently the same, and a short mucro is also present.

*Dimensions.*—

(No. B.G. 7851.)

	mm.
Length (without mucro).....	7.5
Width (without mucro) .....	10.0

*Horizon and Locality.*—Lower Carboniferous Series, Leslie. Fife (B.G.7851).

*Weberides parilis*, sp. nov.  
(Pl. X. figs. 5, 5 a, 5 b.)

Pygidium semi-oval, elongate, longer than wide, narrowly rounded or bluntly pointed posteriorly. Axis prominent, long, slowly tapering to bluntly pointed elevated end, slightly arched longitudinally, convex in cross-section anteriorly, but posteriorly slightly flattened on crest and trapezoidal in cross-section, having its sides somewhat flattened, sloping, and excavated, composed of 18–20 rings (of which the last 8–10 seem to be interrupted in the middle), each bearing a row of minute tubercles with small nodular swellings at their base on each side. Pleural lobes gently arched down, composed of 10–12 somewhat flattened or gently convex pleuræ successively decreasing in size posteriorly and inclined at about 45° or less to the axial furrows, each pleura having a line of sub-median or post-median minute tubercles along the truncation of its thickened posterior edge. Limb gently convex, sharply marked off from pleural lobes by marginal furrow, nearly horizontal, widening gradually to posterior extremity, surrounded by very narrow marginal rim; surface of limb very finely granulated and with very delicate undulating discontinuous concentric striæ near edge.

*Dimensions.*—

(No. B.G. 9094.)

	mm.
Length of pygidium .....	8.00
Width of pygidium .....	c. 6.50
Width of axis at front .....	2.75

*Horizon and Locality.*—Upper Carboniferous Limestone Series (Calmy Limestone), Linn Spout, Dalry, Ayrshire.

*Remarks.*—There is only one pygidium (B.G. 9094) in Mr. Begg's collection on which this species is founded, but its characters are such as to suggest special relations with *Cyphinium kumpani* Weber (1933, pp. 50, 84, t. iii. figs. 1, 5, 30, text-fig. 25), and we may also observe its resemblance to *Ditomopyge yungchangensis* Wang (1936-7, p. 351, pl. i. figs. 1-4 c) from China and to *Gr. ? præpermicus* Weber (1933, pp. 42, 89, t. iii. figs. 19-21; 1937, pp. 76, 138, t. ix. figs. 2-5), which is comparable with *Pseudophillipsia elegans* Gemm., in its pygidial characters. We may note that Weber remarks that *C. kumpani* is difficult to distinguish from "*Griffithides*" *transilis* Weber (1933, pp. 37, 78, t. ii. figs. 17-22). The large number of rings on the axis and the lateral nodules, as well as the trapezoidal cross-section in the Dalry specimen, also resemble *Gr. trapezoidalis* Weber (1937, pp. 75, 138, t. viii. fig. 49; t. ix. fig. 1) from the South Urals, and the general shape of the pygidium on which that species was founded is similar. The pygidia from Beith, which Woodward (1883, pl. iv. figs. 9, 13) figured as *Phillipsia eichwaldi* (Fischer), seem to be identical with our new species. We may also observe its resemblance to the so-called *Phillipsia latilimbata* Schwarzbach (1935, p. 437, t. xxix. figs. 18, 19) from the Upper Carboniferous of Silesia, but none of these species have pygidia with the essential characters belonging to *Griffithides* or *Phillipsia*, and they agree much more closely with *Cyphinium* and the adult *Ditomopyge*. Unfortunately, we do not know the head-shield belonging to this pygidium from Dalry\*.

It may be mentioned that in the Geological Survey Memoir on North Ayrshire (1930), by J. S. Richey and others, it is stated (*op. cit.* p. 176) that trilobites are abundant in the "Upper Linn (Calmy) Limestone," at Linn

\* Since the plates were drawn and this paper in print Mr. R. Tripp of Glasgow has sent me head-shields associated with similar pygidia which possess all the characters of *Weberides*, and are allied to *W. shunnerensis* (King).

Spout, and on p. 249 the following species are recorded from North Ayrshire :—*Phillipsia eichwaldi* (Fisch.), *Ph. derbiensis* (Martin), *Ph. gemmulifera* (Phill.) *Griffithides mesotuberculatus* McCoy and *Brachymetopus* sp.

In the Hunterian Museum of the University, Glasgow, there are pygidia from Bowertrapping, Dalry (A. 35, 37, 490), and from Gair, Carluke (A. 36, 492), completely agreeing with Mr. Begg's specimen from Linn Spout, which are associated with head-shields resembling *Weberides mucronatus* var. *traquairi* (though none of the specimens are perfect), so that we are led to refer *W. parilis* to that genus rather than to *Cyphinium*.

*Weberides dalriensis*, sp. nov.

(Pl. X. figs. 4, 4 a, 4 b.)

**Pygidium** semi-elliptical. Axis long, prominent, gently arched longitudinally, trapezoidal in cross-section, having a flattened crest and slightly excavated sides, tapering slowly to abruptly truncated blunt end, composed of 15–16 rings, each swelling out into a small nodule on axial furrows. Pleural lobes with inner two-thirds horizontal and flattened and outer third arched down, composed of 10–11 flattened imbricating very finely granulated pleuræ having their posterior edge obliquely truncated and furnished with a line of minute tubercles; interpleural furrows deep. Limb sharply marked off from pleural lobes and less steeply inclined, gently convex, rather wide, but of uniform width, finely granulated, and surrounded by a very narrow flattened marginal rim.

*Dimensions*.—

(No. B.G. 9080.)

	mm.
Length of pygidium.....	9.0
Width of pygidium .....	10.0
Width of axis at front end .....	3.5

**Horizon and Locality**.—Upper Carboniferous Limestone Series (Calmy Limestone), Linn Spout, Dalry, Ayrshire.

**Remarks**.—The pygidium above described is complete, except for part of the limb and one pleural lobe. It differs from the species *W. parilis* by its semi-elliptical shape, by the fewer axial rings, and by the limb being of uniform width all round and granulated but not concentrically striated. The character of the pleuræ and of the axis, especially in the number of its rings and its trapezoidal

cross-section, suggest a comparison with *C. kumpani* var. *planiloba* Weber (1933, pp. 53, 86, t. iii. figs. 9, 29; 1937, p. 81, t. ix. figs. 30, 31, 34, 35), from Russia, but it also resembles some forms which have been often referred to or compared with the so-called *Phillipsia* [*Weberides*] *eichwaldi* (Fischer) (see remarks under *Weberides mucronatus* (McCoy), var. nov. *traquairi*), and it may best be put in the same genus.

Genus GRIFFITHIDES Portlock.

*Griffithides* ? *ambiguus*, sp. nov.

(Pl. XI. figs. 6, 6 a, 6 b.)

Pygidium semi-circular. Axis conical, convex, prominent, about one-third the width of the pygidium at front end, tapering rather rapidly to bluntly pointed tip, composed of 12-13 rounded rings bearing small tubercles. Pleural lobes steeply arched down on outer half of limb, composed of 11-12 rounded pleuræ thinning out in their feeble continuation across inner half of limb, bearing row of small tubercles, and separated by well-marked interpleural furrows on pleural lobes, which end on the limb in rather deep pits. Limb concave, of uniform width, rather narrow, slightly upturned, not marked off by any furrow from pleural lobes but nearly at right angles to them, partly crossed by pleural continuations; doublure of limb convex and concentrically striated.

*Dimensions.*—

(No. B.G. 7579.)

	mm.
Length of pygidium.....	5.5
Width of pygidium .....	9.0
Width of axis (front end) .....	3.5

*Horizon and Locality.*—Carboniferous Limestone (Upper Limestone), Balladoole, Isle of Man.

*Remarks.*—The single small specimen on which this species is founded is nearly perfect; the limb with its pleural continuations is complete on the left side, while on the right side a portion of its lower surface (doublure) is shown. The concavity of the limb, its non-demarcation by any marginal furrow from the pleural lobes, and the extension of the pleuræ across part of it suggest its reference to *Griffithides*. Portlock's unnamed pygidium (1843, pl. xi. fig. 12) bears some resemblance to it. But Weller

(1936, p. 705), in his definition of that genus, states that the axis is low, which is not the case in our specimen, the axis being elevated and prominent, as in Weller's genus *Exochops* (1936, p. 707) which is nearly allied to *Griffithides*. But as we are ignorant of the head-shield belonging to this Balladoole specimen, and as *Exochops* is founded on cranial characters, it is safer to place it provisionally in *Griffithides*, for the pygidium much resembles that of the true genotype *Gr. longiceps* Portlock (1843, p. 310, pl. xi. fig. 7 b), which Woodward re-defined and figured (1883, p. 33, pl. vi. figs. 7-9); this species, as others of the genus according to Portlock, having an upturned limb. The variety *angusta* Woodward (1901, p. 153, pl. viii. figs. 6-8), which Weber records also from Russia (1937, p. 68, t. vii. figs. 32, 33, 37, text-fig. 59), may also be compared. The deep pits at the ends of the interpleural furrows on the limb are peculiar to our new species, but the rounded pleuræ are like Weber's variety *rotundipleurata* (1937, pp. 59, 135, t. vii. figs. 36, 37), of his *Gr. longiceps*.

Genus CUMMINGELLA, nov.

*Cummingella balladoolensis*, gen. et sp. nov.

(Pl. X. figs. 1-3, 3 a.)

Head-shield semi-elliptical, rather longer than wide, transversely convex, very slightly convex longitudinally. Glabella sub-oblong, slightly hour-glass in shape, widening a little in front of a weak median transverse constriction, very slightly convex but gently arched down in front with sub-truncate rounded anterior end, extending in front of cheeks and slightly projecting, so as to completely cover and slightly overhang the frontal border; basal lobes small, rounded-sub-quadrate, not swollen, each about one-fourth basal width and one-sixth the length of the glabella; basal furrows strongly curved, meeting neck-furrow at right angles; three pairs of very short fine lateral furrows present, situated at median constriction of glabella, the two posterior pairs gently curved and directed backwards, the anterior pair much shorter and diverging forwards. Surface of glabella bearing a few tubercles, one being situated at the inner end of each of the two anterior lateral furrows. Neck-ring rather wide, nearly flat, with median tubercle on posterior edge; neck-furrow strong, straight. Fixed cheeks and palpebral lobes very

narrow. Facial sutures with anterior branch close to and nearly concentric with side of glabella. Free cheeks elongated, longer than wide, convex, arched down on each side; eyes large, semi-lunate, extending nearly half the length of the glabella and closely placed against it, occupying most of the surface of the cheeks and having on outer side a strong undercut furrow; border of cheeks convex, thick; marginal furrow shallow; surface of cheeks finely and closely pitted and granulated. Occipital segment straight, gently convex; occipital furrow strong. Genal angles with short sharp spines directed straight back.

*Dimensions.*—

(No. B.G. 8601.)

	mm.
Length of head-shield .....	7.50
Width of head-shield .....	10.00
Width of glabella at front .....	4.50
Width of glabella at base .....	4.25

*Horizon and Locality.*—Carboniferous Limestone (Upper Limestone), Balladoole, Isle of Man.

*Remarks.*—There are two head-shields in Mr. Begg's collection representing this species, one of which is nearly perfect. A third specimen, consisting only of the glabella, occurs on the same small piece of rock as the pygidium, lying within 10 mm. of it and described separately below. The characters of the head-shield are hardly distinguishable from some of those of the so-called "*Phillipsia*" *derbiensis* (Martin) as defined by Woodward (1883, p. 12, pl. i. figs. 1–8), except for the presence of some tubercles on the glabella, such as in *Ph.* sp. no. 8 (Weber. 1937, p. 59, t. vi. fig. 37), and the granulation and pitting of the cheeks as well as the presence of short genal spines are further points of difference. Weller (1936, p. 705) has pointed out that *Ph. derbiensis* cannot be ascribed to the genus *Phillipsia*, the shape of the glabella and absence of a border in front of the glabella being the chief distinctive features.

The pygidium of that species as figured by Woodward is quite distinct from the one associated with the present head-shields, which has the following characters:—Pygidium semi-circular; axis convex, conical, prominent, gently arched longitudinally, more than one-third the width of pygidium at front end, composed of 12–13 rings bearing small tubercles, and having weak nodular swellings

on axial furrows. Pleural lobes with inner half horizontal, outer half steeply arched down, composed of 7-8 pleuræ, most with a sharp submedian ridge, the first two pleuræ crossing the limb and there bifurcating, the rest ending abruptly at inner edge of limb. Limb depressed, flattened, smooth, of uniform width all round, sharply marked off from pleural lobes and less steeply inclined; narrow flat rim present round outer edge of limb.

*Dimensions.*—

(No. B.G. 8601 z.)

	mm.
Length of pygidium .....	6.0
Width of pygidium .....	8.5
Width of axis at front .....	3.5
Width of limb .....	1.5

*Horizon and Locality.*—Lower Carboniferous (Upper Limestone), Balladoole, Isle of Man.

*Remarks.*—The solitary pygidium above described, though unlike that figured by Woodward for *Ph. derbiensis*, is almost identical with numerous pygidia from Settle, in the Sedgwick Museum, associated with head-shields attributed to "*Ph.*" *derbiensis*, and apparently so determined by Woodward, but the limb in some of them seems to be less sharply marked off from the pleural lobes, though when the test is missing the separation of the limb is more distinct. *Griffithides carringtonensis* Ether. (Woodward, 1884, p. 41, pl. ix. figs. 6 a, b), from Longnor, Derbyshire, which was founded on a pygidium with very similar characters probably belongs to the same genus, and the pygidium from the Moscovian of Spitzbergen, which Høltedahl (1911, p. 39, t. v. fig. 16) compares with *Gr. carringtonensis*, appears to be much like the Balladoole example. Weber (1937, pp. 52, 53, 131, 132, t. v., vi.) has described several varieties of "*Ph.*" *derbiensis* from Russia having pygidia possessing closely similar characters to those present in the Manx specimen, except that the axis is less conical in shape. Such are his varieties named *belgica* (Weber, 1937, p. 55, t. vi. figs. 16, 17) and *polonica* (Weber, 1937, p. 56, t. vi. fig. 18).

Our new species and the commonly styled *Ph. derbiensis* cannot be put in the genus *Phillipsia* because of the completely different head-shield and pygidium, and the name *Cummingella* is proposed in memory of one of the pioneer geologists in the Isle of Man.

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## EXPLANATION OF THE PLATES.

## PLATE VIII.

- Fig. 1. *Cyphinioides ashfelliensis*, gen. et sp. nov. Imperfect head-shield of complete enrolled specimen.  $\times 5$ . Lower Carboniferous (Ashfell Limestone), near Kirkby Stephen, Yorks. (B.G. 7853.)



*Fig. 1 a.* Side-view of same head-shield.  $\times 5$ .

*Fig. 2.* Pygidium and part of thorax of same specimen.  $\times 5$ .

#### PLATE IX.

*Fig. 1.* *Eocyphinium clitheroense*, gen. et sp. nov. Head-shield.  $\times 4$ . Lower Carboniferous, Clitheroe, Lancs. (B.G. 8602.)

*Fig. 1 a.* Side-view of same head-shield.  $\times 4$ .

*Fig. 2.* *Eocyphinium t bivium*, gen. et sp. nov. Pygidium.  $\times 5$ . Upper Carboniferous Limestone Group (Calmy Limestone), Linn Spout, Dalry, Ayrshire. (B.G. 9089.)

*Fig. 2 a.* Ditto. Side-view of same specimen.  $\times 5$ .

*Fig. 2 b.* Ditto. Outline cross-section of pygidium of same specimen.  $\times 5$ .

#### PLATE X.

*Fig. 1.* *Cummingella balladooleensis*, gen. et sp. nov. Head-shield.  $\times 5$ . Carboniferous Limestone Series (Upper Limestone), Balladoole, Isle of Man. (B.G. 8601.)

*Fig. 2.* Ditto. Anterior view of another head-shield.  $\times 5$ . Same horizon and locality. (B.G. 8601 a.)

*Fig. 3.* Ditto. Pygidium of same species.  $\times 5$ . Same horizon and locality. (B.G. 8601 x.)

*Fig. 3 a.* Ditto. Side-view of same pygidium.  $\times 5$ .

*Fig. 4.* *Weberides dalriensis*, gen. et sp. nov. Pygidium.  $\times 5$ . Upper Carboniferous Limestone Series (Calmy Limestone), Linn Spout, Dalry, Ayrshire. (B.G. 9080.)

*Fig. 4 a.* Ditto. Outline longitudinal section of several pleuræ of same specimen.  $\times 5$ .

*Fig. 4 b.* Ditto. Outline cross-section of same specimen.  $\times 5$ .

*Fig. 5.* *Weberides parilis*, gen. et sp. nov. Pygidium.  $\times 5$ . Upper Carboniferous Limestone Series (Calmy Limestone), Linn Spout, Dalry, Ayrshire. (B.G. 9094.)

*Fig. 5 a.* Ditto. Side-view of same pygidium.  $\times 6$ .

*Fig. 5 b.* Ditto. Outline cross-section of posterior part of same specimen.  $\times 6$ .

#### PLATE XI.

*Fig. 1.* *Weberides mucronatus* (McCoy), gen. nov., var. nov. *traquairi*. Head-shield.  $\times 4$ . Shale in Lower Carboniferous Series, Garple Burn, Muirkirk, Ayrshire. (B.G. 104.)

*Fig. 2.* Ditto. Pygidium.  $\times 4$ . Same horizon and locality. (B.G. 103.)

*Fig. 2 a.* Side-view of same specimen.  $\times 4$ . (B.G. 103.)

*Fig. 3.* Ditto. Another pygidium (mucro broken).  $\times 4$ . Same horizon and locality. (B.G. 102.)

*Fig. 4.* Ditto. Small pygidium, exposing doublure.  $\times 4$ . Lower Carboniferous Series. Leslie, Fife. (B.G. 7852.)

*Fig. 5.* *Weberides mucronatus* (McCoy), var. nov. *lata*. Pygidium.  $\times 4$ . Lower Carboniferous Series, Leslie, Fife. (B.G. 7851.)

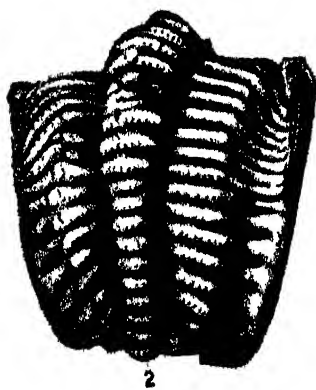
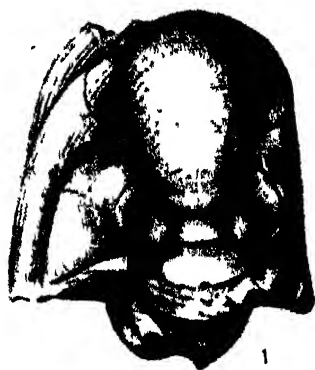
*Fig. 5 a.* Ditto. Outline longitudinal section of several pleuræ of same specimen.  $\times 4$ .

*Fig. 6.* *Griffithides ambiguus*, sp. nov. Pygidium.  $\times 5$ . Carboniferous Limestone (Upper Limestone), Balladoole, Isle of Man. (B.G. 7879.)

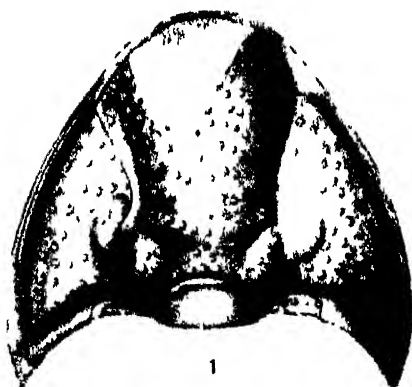
*Fig. 6 a.* Ditto. Side-view of same specimen.  $\times 5$ .

*Fig. 6 b.* Ditto. Outline cross-section of pygidium of same specimen.  $\times 5$ .

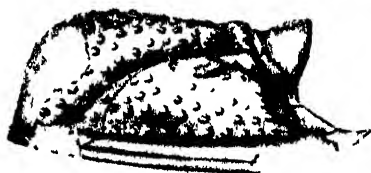
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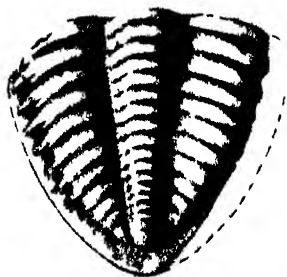
*New Carboniferous Trilobites.*



1



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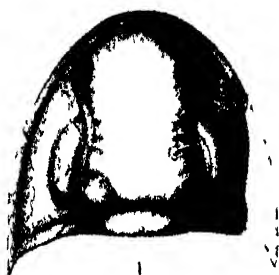


2a



2b

**New Carboniferous Trilobites.**



1



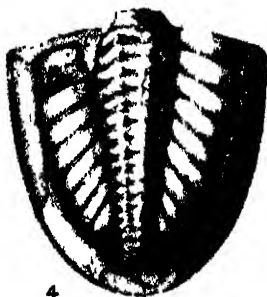
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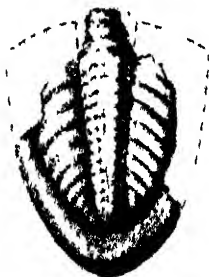
7



2



4



5



4a



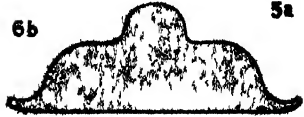
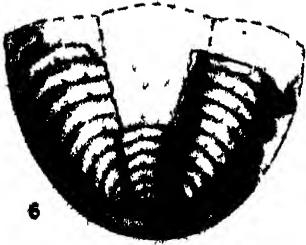
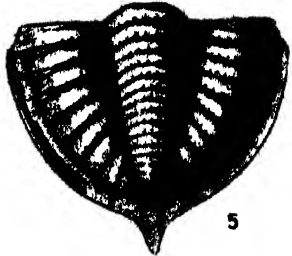
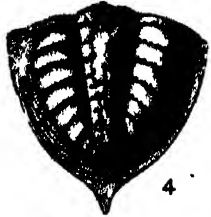
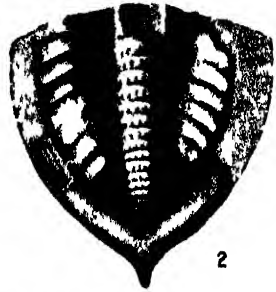
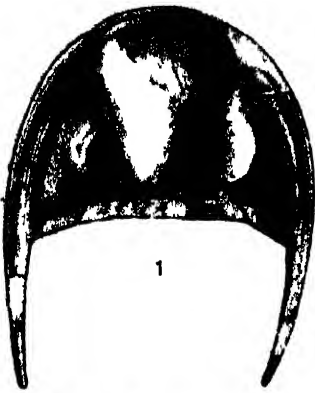
5a



4b



5b



**New Carboniferous Trilobites.**

LVI.—*Keys to the Muscidæ of the Ethiopian Region : Dichæatomyia-group.* By F. I. VAN EMDEN (Imperial Institute of Entomology).

THE keys to the Muscidæ of the Ethiopian Region \* are here continued for the first section of the Phaoniinæ, the last subfamily to be treated. From a phylogenetic point of view this is, of course, the last and most highly-developed group of the Phaoniinæ, which leads over to the Muscinæ. For reasons of expediency, however, it has been worked out first. As in this group a smaller proportion of the new species is represented in the material of the British Museum Ruwenzori Expedition, the descriptions of all the new species not contained in that material and the complete keys, which include preliminary descriptions of the species collected by that expedition, are here published. The full descriptions of the species preliminarily characterized have been typed out (as have those of the Anthomyiinæ described in Bull. ent. Res. xxxii. pp. 255-268), and are available for reference in the British Museum (Natural History).

The types of all the new species are in the British Museum (Natural History).

Literature and synonymy are only mentioned as far as they are not contained in Séguy (1937, Gen. Ins.

\* The keys so far published are found in British Museum (Natural History), Ruwenzori Expedition 1934-35, vol. ii. no. 3 (1939, genera of Muscinæ, species of *Graphomyia* and *Musca*), and no. 4 (1940, genera and species of Ctenosiinæ), and in Bull. ent. Res. xxxii. p. 251 (1941, genera and species of Scatophaginæ, Anthomyiinæ, Lispinæ, and Fanniinæ). Of the other subfamilies recognized by many authors, the Fucelliinæ have been dealt with among the Anthomyiinæ, the Stomoxydinæ (including *Glossina*) have been dealt with, but not keyed, in B. M. Ruwenzori Exp. ii. 3, the Gasterophilinæ and Gyrostigminæ are considered Acalyptrata (see B. M. Ruwenzori Exp. ii. 4, p. 93, and Hendel, 1928, Tierw. Deutschl. 11, Dipt. ii. p. 86), the Egininæ are not known from the Ethiopian Region and, together with the Cobboldiinæ, they are distinguished from the subfamilies here recognized by the presence of hypopleural setæ. *Ruttenia* has no hypopleural bristles and the lower calyptera of the Muscinæ, but its well-developed postscutellum and wing venation approach it to the *Obstrus*-group. *Chauliastetus* also has no distinct hypopleural setæ and has the lower calyptera of the Muscinæ, but it has obviously lost the former. (The presence of a well-developed postscutellum in *Ruttenia* has been assumed by Townsend. Dr. J. Smart has been kind enough to confirm the fact from the single specimen in the collection of the British Museum, this specimen being not in London under the present circumstances.)

fasc. 205, Muscidae), or as far as the former is directly referred to.

The first two connate abdominal segments are counted as one, so that the last entirely free tergite is the fourth. Abbreviations used in describing the legs :—*a*, anterior ; *ad*, antero-dorsal ; *av*, antero-ventral ; *d*, dorsal ; *p*, posterior ; *pd*, postero-dorsal ; *pv*, postero-ventral ; *v*, ventral. In using these expressions the leg should be imagined to be extended in a straight line at right angles to the longitudinal axis of the body.

Other abbreviations :—

<i>ac</i> , acrostichal bristles or hairs.	<i>prst</i> , presutural.
<i>dc</i> , dorsocentral bristles.	<i>R</i> <sub>1</sub> , first posterior cell.
<i>h</i> , humeral cross-vein.	<i>r</i> <sub>1</sub> , first vein.
<i>ia</i> , intra-alar bristles.	<i>r</i> <sub>2+3</sub> , second vein.
<i>m</i> , fourth vein.	<i>r</i> <sub>4+5</sub> , third vein.
<i>m-m</i> , posterior cross-vein.	<i>r-m</i> , small cross-vein.
<i>npl</i> , notopleural setae.	<i>sa</i> , supra-alar bristle.
<i>ph</i> , posthumeral seta.	<i>sc</i> , auxiliary vein.
<i>post</i> , postsutural.	<i>Sc</i> , pterostigma.
<i>pra</i> , prealar bristle.	<i>stpl</i> , sternopleural bristles.
<i>prsc</i> , prescutellar.	

#### DEFINITION OF THE *DICHÆTOMYIA*-GROUP.

The character, which defines this group from the bulk of the Phaoniinae, is the setulose pteropleura. However, as I have found pteropleural hairs in a single species, which clearly belongs to the *Limnophora*-aggregate, the present group must be restricted to those Phaoniinae with setulose pteropleura, in which either the prosternum or vein *r*<sub>1</sub> or both are setulose, and in which the arista is long-plumose. The *pra* is almost always very distinct.

But for *Graueria* Curr., all the species have the prosternum setulose, and *Graueria* deviates also in some other important characters.

#### HABITS.

This group is apparently of little or no economic importance, though most of the material at hand has been sent for identification by practical entomologists. There is a possibility of a slight significance from the hygienic point of view, as the adults of both *Dichæatomyia* and *Pyrellina* frequent faeces and, at least occasionally, occur in houses. Almost everything which has become known on the biology of these genera is due to the efforts of Alexander Cuthbertson.

The larvæ of *Dichæatomyia* develop in cattle dung (Cuthbertson, 1934, Proc. Rhodesia sci. Assoc. xxxiii. p. 34; 1937, Trans. Rhodesia sci. Assoc. xxxv. p. 22), and an Oriental species is said to have been found to attack Pyralid larvæ boring in paddy stems ("ex Pyralid larva . . ."; Malloch, 1929, Ann. & Mag. Nat. Hist. (10) iv. p. 109). Probably they are as a rule coprophagous and saprophagous. Though several labels indicate that adults have been taken in the country (in bush; in dense bush; in rockshade), there are also quite a number of records on the labels which show that some species frequent houses and laboratories (*quadrata lineata*, *serena*, *nigripalpis*). The adults of *quadrata lineata* (Cuthbertson, 1933, Proc. Rhodesia sci. Assoc. xxxii. p. 84), *munroi*, *distanti*, *immaculiventris* (Cuthbertson, 1936, Occas. Pap. Rhodesia Mus. v. p. 57) and *serena* (record on label by R. C. Wood: Cuthbertson, 1937, Trans. Rhodesia sci. Assoc. xxxv. p. 22) have been observed on dung, and those of *cuthbertsoni* on apples infested with bitter rot.

Two species of *Pyrellina* have been found breeding in numbers in the large rotting fruits of the tree *Conopharyngia* (Apocynaceæ) by Cuthbertson (1937, Trans. Rhodesia sci. Assoc. xxxv. p. 26; 1938, l. c. xxxvi. p. 121; 1939, l. c. xxxvii. p. 143), and in the adult stage three species were found by the same author on cow-dung, one of them also on human fæces, another on a dead bird, and the third also at sap exuding from a wound in a stem of a shrub (Cuthbertson, 1933, Proc. Rhodesia sci. Assoc. xxxii. p. 89; 1937, Trans. Rhodesia sci. Assoc. xxxv. p. 26). *P. distincta* has been found on a window (label in the British Museum). It may be assumed that the larvæ occur also in decaying organic matter other than *Conopharyngia* fruits.

### Key to the Ethiopian Genera of the *Dichæatomyia*-group.

- (2). Prosternum bare. Metathoracic spiracle without setulose hairs. Hind tibiae with a strong postmedian *pd* (almost *p*) setæ. Dorsal surface of  $r_1$  and  $r_{4+5}$ , the latter to beyond  $r-m$ , setulose;  $m$  almost straight at apex. Parafrontalia with a pair of proclinate setæ (small in male); interfrontalia of female with a pair of cruciate setæ. (2-4)+3 *acr*. Scutellum setulose to the lower edge . . . . . *Graueria* Curr.



- 2 (1) Prosternum setulose. Metathoracic spiracles always with some setulose black hairs over at least (*Pyrellina*) posterior half. Hind tibiae with 1-2 indistinct to moderately long *pd* setae. Cruciate interfrontal setae absent. *acr* hair-like, except usually for the *prae*.
- 3 (6).  $R_1$  wide at apex, where it is not or only slightly narrower than in middle. Dorsal surface of all the veins (except costa) bare, but ventral surface of  $r_{4+5}$  often setulose at base. Body never strongly metallic, at most black with slight brassy reflections. Female without a proclinate seta on parafrontalia.
- 4 (5). *m* practically straight in apical part. One small and two strong *post dc.* *prae acr* absent. Frontal profile much shorter than facial profile, frons of male as wide as that of female. Third antennal joint of male more than thrice as long as wide. . . . . *Neaveia* Mall.
- 5 (4). *m* distinctly though often only slightly bent forward at apex, or the other characters different . . . . . *Dichæatomyia* Mall.
- 6 (3).  $R_1$  very strongly narrowed to apex, where it is not much wider than *r-m* is long. At least  $r_{4+5}$  setulose on ventral and dorsal surfaces from base half-way to *r-m*, and at least one other vein setulose, usually several, including  $r_1$ . Head and thorax black with strong metallic blue or green reflections; abdomen similar or partly or wholly orange. Both sexes with a strong proclinate seta on parafrontalia . . . . . *Pyrellina* Mall.

#### GRAUERIA CURR.

Curran, 1935, Amer. Mus. Novit. 776, p. 27 (genotype *ethelia* Curr.).

Though the strongly-developed pteropleural hairs link *Graueria* to this group, the bare prosternum and metathoracic spiracle and the strong *pd* of the hind tibiae are characters of *Phaonia*, with which it is perhaps more closely related. However, some of the other characters are suggestive of this group or of the Muscinæ, and the genus may be truly transitional between the *Phaonia*-group and the present aggregate. *G. (ethelia)* Curr. 1935 (n. syn.) is no doubt identical with (*Phaonia*) *setinervis* Skin, 1913.

#### NEAVEIA MALL.

The only species so far described is very similar in structural characters to *Dichæatomyia polita* Mall., the genotype of the latter genus. However, in *D. polita*

the *m* is very conspicuously curved forward at apex, and the male is holoptic. *D. latifrons* Mall. seems to be somewhat intermediate, the male being dichoptic, and *m* being curved forward as in *D. polita*. A second species has been collected by the B. M. Ruwenzori Expedition. In some specimens of it *m* is distinctly curved forward, so that the gap between the two genera becomes still narrower.

*Key to the Species of Neaveia.*

- 1 (2). *R*<sub>5</sub> slightly widened from second third to apex, *r*<sub>4+5</sub> being very gently curved. Thorax entirely pale. The basal two antennal joints, jowls, and face reddish yellow, palpi yellow. *flavida* Mall.
- 2 (1). *R*<sub>5</sub> distinctly though slightly narrowed from second third to apex, *r*<sub>4+5</sub> being strongly curved. Thorax with a piceous suffusion that reaches the *ph* and almost reaches the *ia*. Antennae, jowls, and face fuscous, though somewhat reddish translucent in places, palpi usually fuscous. 5.1–5.6 mm. UGANDA: Ruwenzori; Kigezi District. . . . *convergens*, sp. n.

DICHÆTOMYIA Mall.

Séguy (1937, Gen. Ins. 205, p. 343) has included several groups in this genus which are not really closely related with it. *Auria* Mall. and *Spilopteromyia* Mall. have the prosternum bare, the posterior spiracle without setulose hairs, and the hairs of the pteropleura not extending to the infrascapular ridge. In *Spilopteromyia*, moreover, *m* is very strongly upcurved and *R*<sub>5</sub> thus narrow at apex.

*Papuaia* Mall. has, by an error of Malloch's, been included in his key to three genera with setulose pteropleura (1921, Ann. & Mag. Nat. Hist. (9) viii. p. 422). Actually, the pteropleura is bare and the prosternum haired, the spiracle without setulose hairs, all of which characters were correctly stated in the original description on the same page. (The specimen which served Malloch for his description is in the British Museum.) *Papuaia*, thus, does certainly not belong to *Dichætomyia*. *Lasiopelta* Mall. also has the pteropleura bare and cannot possibly be united with the present genus.

Enderlein (1935, S. B. Ges. naturf. Fr. 1935, p. 244) cites as genotype of *Lophomala* End., 1927, *fasciculifera* Stein, and Séguy (1937) *albivitta* Stein, but Malloch has already in 1928 (Ann. & Mag. Nat. Hist. (10) i. p. 468) chosen

*flavipalpis* Stein. As no genotype had been fixed previously, and as the name was included in Enderlein's list, Malloch's fixation of *Mydæa flavipalpis* Stein, 1915, as genotype is valid. According to some ootypes in the British Museum this is a true *Dichæatomyia*, and *Lophomala*, thus, a synonym of that genus.

*Panaga* Curr., 1928, is here treated as a subgenus, and *Macrozanthomyia* Mall., 1930, as pointed out by Curran (1935, Amer. Mus. Novit. 775, p. 20), is a synonym of it. The species of both *Panaga* and *Dichæatomyia*, s. str., have been keyed by Curran (l. c. pp. 13-23), and those of *Panaga* by Malloch (1930, Ann. & Mag. Nat. Hist. (10) v. pp. 473-479), but a rather considerable amount of corrections to the existing literature is necessary, and the number of species is being almost doubled in the present key.

*Spilogaster phasiæformis* Stein does not belong to *Dichæatomyia*. The specimen on which Malloch's statement was based is in the British Museum, and is *Dichæatomyia albivitta* Stein. The black vittæ are overlaid with dense white dust, which leads to *albivitta* in Stein's key. The apex of the abdomen is largely black, as stated in the description, whereas it is said to be entirely pale in *phasiæformis*. The eyes are subcontiguous (in *phasiæformis* separated by a narrow frons in male) as the interfrontalia wholly disappear, the mid-tibiæ have two setæ on the posterior surface (in *phasiæformis* 4-5 rather short setæ), and the thoracic vittæ are narrow, whereas they are wide and reach the humeral callus in *phasiæformis*. In all these characters and the size a species of *Alluaudinella* fits Stein's description, thus justifying Stein's statement of 1919.

Beside the species mentioned by Malloch, Curran and Séguy, the following Ethiopian species were said by Enderlein, obviously from the types in the Berlin Museum, to belong to *Lophomala*:—*analis* Stein, 1906, *anax* Speis., *arguta* Karsch, 1879, *evanescens* Stein, 1906, *fumaria* Stein, 1906, *gigas* Stein, 1906, *lativentris* Stein, 1906, *mollis* Stein, 1906, *nigripalpis* Stein, 1913, and *pilifemur* Stein, 1906. Of these species *gigas* is the type of *Æthiopomyia* Mall., and *arguta*, *evanescens*, and perhaps—in my opinion almost certainly—*lativentris* belong, according to Malloch (1925, Ann. & Mag. Nat. Hist. (9) xvi. p. 365) to *Allua-*

*dinella*. I have seen no description of *anax* Speis., and think this must be a manuscript name; it should be noted in this connection that Enderlein does not cite a year for this name. *Spiloptera mollis* has, according to Stein (1918, Ann. Mus. Nat. Hung. xvi. p. 191), later on been re-described by him as *hirticeps* and is obviously a *Helina*, as which it has been identified by Malloch. Enderlein's reference to this species must therefore be due to an error of some kind. In 1935 (S. B. Ges. naturf. Fr. 1935, p. 244) Enderlein lists a number of species, among them several of the species discussed here, as *Alluaudinella*, but the sole and only character used by him for distinguishing *Alluaudinella*, *Lophomala*, and *Dichæatomyia* is the number of *post dc* (4, 3, and 2 respectively), so that his list cannot be used for the present purpose. Thus, *analis*, *fumaria*, *nigripalpis*, and *pili-femur* are left as additional described species of *Dichæatomyia*. All the Ethiopian species but *analis* and *graueri* have been recognized in the material at hand.

*Key to the Ethiopian Species of Dichæatomyia.*

- 1 (42). Infra-alar bulla not setulose, only covered with microscopic pile. (Subgenus *Dichæatomyia*, s. str.).
- 2 (13). Front tibiae without a *p* submedian seta.
- 3 (8). Sides of scutellum bare on lower half. 3 *post dc*.
- 4 (7). Femora and tibiae wholly pale.
- 5 (6). Wings entirely pale hyaline. Hind femora with only 3-4 strong setae (in apical fourth of *av* surface). Abdomen wholly testaceous with rather conspicuous light brown pruinosity, especially on apical half, which is therefore mat ..... *pallidula* Curr.
- 6 (5). Wings fuscous from apex of *sc* to apex of  $r_{3+4}$ , the hind border of the suffusion lying halfway between  $r_{3+4}$  and  $r_{4+5}$ . Hind femora with 2-3 *pv* and one *av* seta in basal half, and another *av* not much beyond basal half ..... *gibbinsi*, sp. n.
- 7 (4). Femora brown. Wings not clouded. Hind femora with a complete row of 7-8 *av* setae. Thorax black, humeri yellow ..... *conformis* Curr.
- 8 (3). Sides of scutellum setulose along lower margin (unknown in *analis*, but then four *post dc* present, and the abdomen strongly blackened at apex).

- 9 (12). Four *post dc*, though one or two of them are more or less weak (if apparently only three, the first at least as distant from suture as from second). Antennae reddish yellow.
- 10 (11). Thorax with a pair of blackish, densely white-dusted vittae along the *dc*. Palpi reddish yellow. Abdomen without dark marks ..... *macfiei* Mall.
- 11 (10). Thorax concolorous, with only a small median spot of reddish white dust in front. Palpi fuscous. Abdomen with the first segment and the narrow anterior margin of the second pale, the remaining part piceous black, shining ..... *analis* Stein \*.
- 12 (9). Three *post dc*, the first of them much nearer to suture than to the second. Third antennal joint infuscate, except near base. Thorax black between the *ph* and *ia*, whitish dusted, with the outer margins of the dark area and a pair of narrow vittae between the *dc* almost devoid of dust; pleurae largely infuscate. Palpi fuscous ..... *quadrata lineata* Stein.
- 13 (2). Front tibiae with a *p* submedian seta.
- 14 (27). Only two strong *post dc*, the anterior 1-2 *post dc* much smaller and sometimes even absent, the first strong one at least almost as distant from suture as from the other strong one.
- 15 (20). *prec acr* absent. At most one weak *post dc* in front of the two strong ones. Halteres fuscous †. *m* conspicuously curved forward at apex. Frontal profile not much shorter than facial profile. Third antennal joint less than thrice as long as wide.
- 16 (19). Sides of scutellum setulose near lower edge. All the spicules on the costa small, except for the costal spine. Tibiae pale. Frons of male much narrower than that of female, about as wide or twice as wide as the frontal triangle. Anterior *prst dc* small or indistinct ..... *polita* Mall. .... 17.
- 17 (18). Femora pale ferruginous. Epaulette and basicoastal scale reddish brown. Anterior *prst dc* small, but distinct .. *polita polita* Mall.

\* Curran concludes his description of *liberia* Curr.: "This species resembles *Spilogaster analis* Stein, but the tarsi are not black." However, *liberia* cannot be closely related with *analis*, as it has a *p* seta on the fore tibiae.

† Halteres yellow. *m* usually straight near apex. Frontal profile much shorter than facial profile, frons of male as wide as that of female. Third antennal joint of male more than thrice as long as wide (to be measured †); see *Neaveia*.

- 18 (17). Femora piceous to black. Epaulette and basicostal scale fuscous. Anterior *pret dc* very small, sometimes indistinct. UGANDA: Ruwenzori; Kigezi District; Nkokonjeru. BELGIAN CONGO: Tshibinda . . . . . *polita ugandana*, *sp. n.*
- 19 (16). Sides of scutellum bare on lower half. Two of the spicules shortly beyond *h* much longer than the following ones, one of them as long as the costal spine. Tibiæ black or brownish black. Frons of male as wide as that of female . . . . . *latifrons* Mall.
- 20 (15). *prec acr* very distinct. Usually two weak *post dc* in front of the two strong ones, the first strong *post dc* at least as distant from suture as from the other strong *dc*.
- 21 (26). Sides of scutellum setulose near lower edge. Anterior *pret dc* always very small, if the femora are black.
- 22 (23). Anterior *pret dc* strong, the first of the strong *post dc* as distant from suture as from the last *post dc*. Femora and halteres yellow . . . . . *neavei*, *sp. n.*
- 23 (22). Anterior *pret dc* very small, the first of the strong *post dc* considerably more distant from suture than from the last *post dc*.
- 24 (25). The *pd* apical spur of the fore tibiæ one-half to two-thirds the length of the *pv* spur. Paramedian dark vittæ very narrow and broadly separated, hardly dilated behind suture and separated there by a densely dusted vitta which is much wider than they (but as in *somerani* in one of the pale specimens). Coloration very variable, but the scutellum always translucent brown at sides. Femora yellow to black, thorax light brown to blackish brown . . . . . *liberia* Curr.
- 25 (24). The *pd* apical spur of the fore tibiæ virtually as long as the *pv* spur. Paramedian dark vittæ of thorax less narrow and less distant, strongly dilated behind suture, where they are separated by a less densely dusted vitta, which is narrower than they. Body black, including scutellum; tibiæ and tarsi reddish yellow, somewhat infuscate . . . . . *somerani*, *sp. n.*
- 26 (21). Sides of scutellum bare on lower half. Anterior *pret dc* well developed, though shorter than the posterior *pret dc*. Femora black. Vittæ of mesonotum, *post dc* and apical spurs of the fore tibiæ as in *liberia* . . . . . *devia* Curr.

- 27 (14). Three strong *post dc*, the first much nearer to suture than to the second ; if a small *post dc* is present in addition to them, it lies *between* the first and second strong setae. Anterior *prst dc* always well developed, though sometimes only half as long as the posterior *prst dc*. Femora (at least largely) and tibiae pale.
- 28 (20). Sides of scutellum setulose near lower edge. *prsc* very strong, almost two-thirds the length of the last *dc*. Mesonotum with a large piceous-black median suffusion, which reaches the *ph* and virtually reaches the *ia*. Antennae and palpi fuscous. Wings strongly infusate. 7.8 mm. UGANDA : Ruwenzori ..... *sellata*, sp. n.
- 29 (26). Sides of scutellum bare on lower half. *prsc* weak to moderately strong, never more than half as long as the last *dc*.
- 30 (30). Wings unspotted. Fore tibiae with the normal single *p seta* near middle. Femora wholly pale (*defectiva* ?).
- 31 (32). *prsc* absent. Palpi and thorax wholly pale, except for the metanotum, the triangular sclerite below the infra-alar bulla also pale. Antennae reddish yellow, with the third joint largely infusate (♀). *pra* weaker than the second *npl* ..... *defectiva*, sp. n.
- 32 (31). *prsc* distinct.
- 33 (36). *pra* longer than the second *npl*, one-third to one-half the length of the anterior *sa*. Pleurae wholly pale, including the triangular sclerite below the infra-alar bulla ; mesonotum wholly pale. Hairs of prosternum pale and inconspicuous, only in single file.
- 34 (35). First *prst dc* two-thirds to three-fourths the length of the second ; *acr* fine and erect, as long as the third antennal joint is wide. Palpi brownish orange. The basal two antennal joints dull testaceous, only slightly infuscated. Mesonotum glossy, dust very inconspicuous. 5.3-6.5 mm. KENYA : Chyulu Hills. UGANDA : Ruwenzori ..... *xanthopleuris*, sp. n.
- (34). First *prst dc* one-half the length of the second ; *acr* stouter, more inclined, conspicuously shorter than the width of the third antennal joint. Palpi and antennae fuscous. Mesonotum only moderately shining, the dust more conspicuous. 5.5-7 mm. KENYA : Mt. Elgon ; Aberdares ... *simillima*, sp. n.

- 36 (33). *pra* much shorter than the second *npl*, less than one-fourth the length of the anterior *sa*. Pleurae brown, at least on the apical part of the triangular sclerite below the infra-alar bulla; mesonotum with more or less extended dark coloration. Hairs of prosternum stronger and more numerous, in double or treble file.
- 37 (38). Third and fourth abdominal segments each with one rather weak lateral discal. Mesonotum pale testaceous, with a broad, dark brown median vitta, which reaches the *dc*, and which tapers from the last *dc* to apex of scutellum; its median part overlaid by a denser vitta of pale grey dust which tapers towards suture. Anterior *ia* indistinct, hardly stronger than the adjacent hairs and less than half as long as the posterior *ia*. 6.5-7.2 mm. UGANDA: Kigezi District; Ruwenzori. . . . . *vitticollis*, sp. n.
- 38 (37). Third abdominal segment with 2-4 lateral discals, fourth with a complete row of strong discals. Mesonotum variable in coloration, but never with a contrasting pattern like that of *vitticollis*, dull ferruginous to piceous-black, with paler and darker indefinite spots and more or less conspicuous ferruginous to cinereous pollinosity. Anterior *ia* usually long, several times the length of the adjacent hairs, and two-thirds the length of the posterior *ia* or longer, seldom as in *vitticollis*. . . . . *munroi* Curr.
- 39 (30). At least *m-m* and apical part of *r*<sub>3+2</sub> with a distinct suffusion. Either fore tibiae with two *p* setae, or femora with a dark spot at apex. Setulose hairs of prosternum pale. Pleurae wholly pale, including the triangular sclerite below the infra-alar bulla.
- 40 (41). Fore tibiae with the normal single *p* seta. Femora with a brown streak on apical fourth or fifth of dorsal surface. *pra* smaller than second *npl*. *r-m* with a roundish suffusion, the apical suffusion on *r*<sub>3+2</sub> and *r*<sub>4+2</sub> beginning at level of *m-m*. Mesonotum with a dark brown vitta from neck to apex of scutellum, this vitta does not reach the *prst dc* exteriorly, but passes the second and third *post dc*. . . . . *deceptiva*, sp. n.
- 41 (40). Fore tibiae with two *p* setae, one before middle, the other at two-thirds. Femora wholly pale. *pra* longer



- than second *npl.* *r-m* without a suffusion, the apical suffusion on *r<sub>4+5</sub>* beginning opposite *Sc.* Mesonotum wholly pale ..... *suffusus*, sp. n.
- 42 (1). Infra-alar bulla setulose, in addition to the microscopic pile. (Subgenus *Panaga* Curr.)
- 43 (44). Four *post dc.* Mesonotum with \* a pair of narrow black or blackish vittæ along the *dc.*, these vittæ are densely whitish-pollinose in posterior view. Fourth abdominal tergite almost entirely black. Post-alar declivity and lower half of sides of scutellum setulose. Fore tibiæ without a *p* seta, but with a not very strong *ad.* Wings pale (forma typica) or the front part of the apical half more or less strongly browned (ssp. *limbipennis* Curr.) ..... *albivitta* Stein.
- 44 (43). Three *post dc.* Mesonotum without a pair of narrow black vittæ along *dc.*
- 45 (70). Fore tibiæ without a *p* submedian seta.
- 46 (53). Sides of scutellum bare on lower half. Setulose hairs of infra-alar bulla golden-yellow. Femora, tibiæ, and the basal two antennal joints wholly pale.
- 47 (48). Dorsal surface of thorax and abdomen wholly pale. Third antennal joint of male wholly orange-yellow. Median dusted vitta slightly wider and paramedian shining vittæ somewhat narrower. *pret aor* hairs of male hardly longer than width of third antennal joint. Palpi yellow. .... *immaculiventris* Mall.
- 48 (47). Abdomen with a distinct dark pattern, either with piceous transverse bands, or the apical two segments black. Median dusted vitta slightly narrower, paramedian shining vittæ somewhat wider.
- 49 (52). Palpi yellow.
- 50 (51). Thorax with a broad brown suffusion along middle, which widens behind and extends to disc of scutellum (as in *serena*). Abdomen of female with broad piceous transverse bands, which are narrowly interrupted in middle. Third antennal joint of male wholly orange-yellow. *pret aor* hairs of male as long as diameter of third antennal joint. (*D. maculiventris* Mall. 1930, Curran, 1935, nec Stein, 1909, Mall. 1928) ..... *mallochi*, nom. nov.
- 51 (50). Thorax wholly testaceous to pale ferruginous. Abdomen with the basal

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\* If without, see *D. (s. str.) analis* Stein, p. 680.

- two segments wholly pale, and the apical two segments wholly black. Third antennal joint fuscous, with the base narrowly orange-yellow. *pret ac* hairs of male twice as long as diameter of third antennal joint. . . . . *outhbertsoni*, sp. n.
- 52 (49). Palpi brown. Thorax wholly pale ferruginous. Abdomen with a narrow hind-marginal band on each segment, and a large brown suffusion on most of the third and fourth segments. Hind femora with a complete row of rather long *av* and *pv* setæ. 6.7 mm. UGANDA: Ruwenzori . . . . . *edwardsiana*, sp. n.
- 53 (46). Sides of scutellum setulose near lower margin. Setulose hairs of infra-alar bulla black.
- 54 (57). All the tibiae conspicuously infuscated. Palpi brown to black.
- 55 (56). 9-10 mm. Hind femora with at least three long, but not very strong *av* from base to middle, three strong, but short *av* near apex, and several rather distant *pv* setæ. Palpi black. Mesonotum of female with a small spot of reddish-white dust anteriorly between the *dc*, of male with three vittæ, which gradually disappear behind suture. (*D. apicalis* (Stein), Mall., Curr., nec Stein) . . . . . *fuscitibia* Stein.
- 56 (55). 5-7 mm. Hind femora without *av* or *pv* setæ except near apex, where a few moderately strong *av* and, in male, a tuft of long and dense black *pv* setæ is present. Palpi brown. Mesonotum without a spot of whitish dust . . . . . *fasciculifera* Stein.
- 57 (54). Tibiæ not infuscated, or only the hind tibiae slightly so.
- 58 (59). Mentum very stout, more than twice as wide as third antennal joint. Abdomen pale testaceous, third and fourth segments each with a small piceous spot at hind angles, on the fourth segment these spots are much wider and almost contiguous in middle. Mesonotum without dusted vittæ when seen from behind. Hind femora with a row of strong *av* and *pv* setæ over their entire length. Tarsi yellow, slightly infuscate towards apex. Palpi yellow . . . . . *crassirostris*, sp. n.
- 59 (58). Mentum normal, less than twice the width of the third antennal joint. Third and fourth abdominal segments without spots confined to the hind angles, but often with extended dark coloration, which is

- most developed on median part, but may reach the hind angles.
- 60 (65). Tarsi wholly reddish yellow, except sometimes for the last joint.
- 61 (64). Pteropleura pale below the infra-alar bulla. Palpi pale yellow, seldom somewhat infusate. Post-alar declivity usually with some small setulose hairs. Abdomen often wholly pale. Median dusted vitta of mesonotum more conspicuous and silver-white in front, rather narrow and pointed behind in female. . . . . *ovata* Stein. . . . 62.
- 62 (63). 8-11 mm. Female with a complete row of *av* setae on hind femora. Fourth abdominal segment sometimes without discals . . . . . *ovata* Stein, s. str.
- 63 (62). 6-8 mm. Both sexes with only 2-5 *av* setae towards apex of hind femora. Median dusted vitta often less distinct. Fourth abdominal tergite always with discals . . . . . *ovata*, var. *rutile* Stein.
- 64 (61). Pteropleura with a black spot "in front" (obviously on the triangular sclerite below the infra-alar bulla). Palpi reddish brown. Post-alar declivity bare. Abdomen with the apices of the first to third segments narrowly brown; thorax rusty reddish with four broad darker vittae, the spaces between them thinly white-pollinose in posterior view. Female about 8 mm., with only two *av* setae on basal half of hind femora, those of apical half fine, *pv* surface without setae in basal three-quarters. *graueri* Curr.
- 65 (60). Tarsi wholly black or brown. 5-7.5 mm. Thorax not dusted or rather uniformly dusted and the pollinosity not much less conspicuous behind suture; the median vitta, if present, hardly more conspicuous and not silver-white in front. Post-alar declivity seldom individually with a few minute black hairs.
- 66 (69). Wings strongly clouded along front margin. Third antennal joint wholly yellow or orange-yellow ( $\delta$  only known).
- 67 (68). Palpi testaceous. Cloud of wings large, extending from apex of *sc* over both transverse veins to apex. Hind femora with two stronger *av* hairs near base and 2-4 *av* bristles near apex, the *pv* surface only with a few stronger setulose hairs at apex. *nebulosa*, sp. n.
- 68 (67). Palpi dark brown. Cloud of wings reaching to half-way between  $r_{2+3}$

- and  $r_{4+5}$  and to apex of the former. Hind femora with a complete row of 7-8 rather long and strong *av* setæ, and two rather strong *pv* shortly before and at middle . . . . . *gilvicornis* sp. n.
- 69 (66). Wings hyaline. Third antennal joint infusate on more than apical half, even in male. Palpi piceous to black (*fuscitibia* (Stein), Mall., Curr., nec Stein; *pallens* Curr., n. syn.) . . . . . *fumaria* Stein.
- 70 (45). Fore tibiae with a *p* submedian seta.
- 71 (78). Sides of scutellum bare on lower half. Setulose hairs of infra-alar bulla golden-yellow (though one or two blackish hairs may be among them).
- 72 (75). *pra* shorter than second *npl* and at most one-half the length of the first *post dc*. Palpi yellow to orange. Wings hyaline. *prec* present. Tarsi and border of the calyptre testaceous\*, the last three joints of the former infuscated.
- 73 (74). Thorax with a broad dark-brown median suffusion, which widens behind and encroaches upon scutellum, but which is sometimes vestigial or wholly absent. The fine bristly *pv* hairs near apex of hind femora shorter than the preapical *av* setæ. The dark marks of the third and fourth abdominal segments suffused, if present . . . . . *serena* Stein.
- 74 (73). Thorax without a dark median suffusion. The fine bristly *pv* hairs near apex of hind femora mostly longer than the *av* setæ. The dark marks of the third and fourth abdominal segments with more clearly defined (though not quite sharp) boundaries . . . . . *distanti* Mall.
- 75 (72). *pra* longer than second *npl* and at least one-half the length of the first *post dc*. Palpi fuscous-yellow to fuscous, or wings with dark suffusions on *m-m* and in anterior part, especially along apical parts of  $r_1$  and  $r_{4+5}$ , but not on *r-m*. Border of upper calyptre and of interior part of lower calyptre infuscate.
- 76 (77). Wings hyaline. Palpi fuscous-yellow to fuscous. Third antennal joint fuscous except at base. Hind femora of male with a complete row of long, fine *av* and *pv* setæ. Thorax

\* Tarsi and border of calyptre dark brown. *prec* absent. See *D. (s. str.) defectiva*, sp. n., in the type of which the infra-alar bulla of one side bears a single black setula.

- entirely testaceous to largely infuscate on dorsum. Tarsi piceous.. *piliifemur* Stein.
- 77 (76). Wings with dark suffusions on *m-m* and in anterior part, the suffusion along  $r_{2+3}$  beginning half-way between apices of  $r_1$  and  $r_{2+3}$  \*. Palpi yellow to orange. Fore tibiae with the normal single submedian *p* seta. Third antennal joint wholly yellow. *vumbana*, sp. n.
- 78 (71). Sides of scutellum setulose near lower margin. Setulose hairs of infra-alar bulla black. *pra* smaller than second *npl*.
- 79 (84). Hind femora with at least two quite strong *pv* setae in basal half, often with a complete row. [.... 81.
- 80 (83). Abdomen and palpi pale ferruginous.. *hargreavesorum*, sp. n.
- 81 (82). Fore tibiae without *ad* setae. Mesonotum only with a dusted median spot in front. *m-m* steep and only slightly sinuate ..... [*greavesorum*, sp. n.
- 82 (81). Fore tibiae with a quite strong *ad* seta in middle and a smaller one at three-quarters. Mesonotum with three dusted vittae on presutural part. *m-m* oblique and rather strongly sigmoid ..... *hargreavesorum har-*
- [*nialana*, sp. n.
- 83 (80). Abdomen with more or less broad piceous to black bands on the last two or three segments, often the last two segments entirely or almost entirely dark. Palpi usually fuscous. *hargreavesorum*
- 84 (79). Hind femora with at most one moderately strong or two very weak *pv* setae in basal half. Palpi usually fuscous. Abdomen with more or less broad piceous to black bands on the last two or three segments, often the last two segments entirely or almost entirely dark. (Sometimes with a few black setulae below the lower calyptra on postnotum: *obscuritarsis* Mall.) (syn. : *celosia* Mall. and *celosia* var. *dorsalis* Mall.) ..... *fasciventris* Mall.
- nigripalpis* Stein.

*Dichæatomyia gibbinsi*, sp. n., ♀.

*Length* of head and thorax 4.0 mm. (abdomen missing, entire length ca. 7 mm.), of wings 6.9 mm.

*Head* fuscous, densely pale grey dusted, interfrontalia black, parafrontalia black and, like the upper part of the

\* Suffusion along  $r_{2+3}$  beginning in *Sc*. Fore tibiae with two *p* setae. Third antennal joint infuscate in apical part (?). Each infra-alar bulla with a single black setula in type. See *D. (s. str.) suffusa*, sp. n., p. 683.

parafacialia, not very densely silver-white dusted. Eyes with sparse very short hairs. Frons slightly narrowed to vertex, almost one-third head-width anteriorly; sides of face almost straight, not much more strongly diverging towards lower margin of eyes than sides of frons; parafrontalia not very conspicuous, narrowed from both extremities to middle, where they are about one-sixth the width of the interfrontalia, with two strong (and two small) inclinate and two rather strong reclinate setæ. Inner verticals and ocellars strong, outer verticals rather strong, postverticals conspicuous though not long. Antennæ pale ferruginous, the third joint browned, except at base, more than thrice as long as wide, slightly exceeding mouth-margin, but falling short of level of lower eye-margins by half its width; arista long-plumose, slightly wider near middle, including plumosity, than the third antennal joint is long. Parafacialia less than one-half, jowls one-and-a-half times the width of the third antennal joint. Palpi sooty brown.

*Thorax* ferruginous, covered with moderately dense white pollinosity, which becomes less dense and rather inconspicuous behind suture; with a pair of narrow shining paramedian vittæ to the inner side of the *dc* and a pair of broader sublateral shining vittæ to the outer side of the *dc* and somewhat passing the *prst*; these vittæ widen gradually towards and beyond suture, the width of the vittæ being approximately reversed near scutellum; the sublateral vittæ divided behind suture by a vitta of whitish dust between the *ia* and *sa*; scutellum only with an oblong-triangular, not very conspicuous spot of whitish dust on each side of base. *acr* hair-like, in 9-10 irregular rows; *prsc acr* and *prsc ia* rather strong, almost as long as the first *prst dc*, which is half as long as the second, three strong *post dc*, two humerals, the upper one much smaller, one *ph*, one *prst*, two *npl*, the second somewhat weaker than the first, but much stronger than the *pra*, two rather strong *post ia*\*, *pra* one-third the length of the first *sa*, but slightly longer than the second, anterior post-alar strong, posterior post-alar very strong like the *prst*, first *sa* and the two pairs of scutellars; scutellum setulose on dorsal surface, with a rather strong

\* This means in this and the other descriptions: two *ia* in addition to the *prsc ia*.

subbasal lateral and 2-3 pairs of small preapical discals. Anterior propleural and lower prostigmatal small, curved upward, posterior propleural and upper prostigmatal strong, mesopleura with 3+1 strong and some fine setæ on hind margin and a small seta opposite the first *npl*, otherwise setulose; 1+2 *stpl*, the posterior much longer, the lower conspicuously shorter than the anterior one.

*Abdomen* of type missing.

*Legs* testaceous to pale ferruginous, the tarsi strongly infuscate. Fore femora with a *d*, *pd*, and *pv* row of about eight setæ, which become slightly stronger though not longer towards apex, fore tibiæ without setæ but for a *d* and *pv* apical spur, which are of equal size; mid-femora with a small *ad* preapical, a transverse row of four stronger preapicals from the *d* to the *p* surfaces and two very fine *pv* in basal half, mid-tibiæ with two *pd* setæ; hind femora with an *ad* (almost *d*) row of 14-18 short setæ, one *av* at basal fourth, one slightly beyond middle, three near apex, 2-3 *pv* in basal half, and two *d* and one *pd* preapical, hind tibiæ with an *ad* at middle, a very small *av* almost level with it, a small *av* somewhat beyond it, and two very small *pd* at about two-fifths and three-fifths.

*Wings* brownish hyaline, the fore margin strongly infuscated from the costa to half-way between  $r_{3+4}$  and  $r_{4+5}$  and shortly from before the apex of *sc* to apex of  $r_{3+4}$ ; veins lighter and darker brown.  $r_1$  ending beyond level of *r-m*, the latter somewhat beyond middle of discal cell,  $r_{4+5}$  and *m* hardly converging before that point, at which the latter is distinctly though not strongly bent towards the former. Calyptræ brownish white, subhyaline, border and fringe pale brown, lower calyptra strongly projecting. Halteres brownish.

UGANDA : Jinja, 15. ix. 30 (*E. G. Gibbins*), ♀ type.

### *Dichæatomyia macfieii* Mall.

According to Curran (1935, Amer. Mus. Novit. 776, p. 14) the fore tibiæ have a *pd* seta, but the original description states that there is none. The type has not yet been returned to London, but a single male from GOLD COAST : Yapi, N. Terr. xi. 15 (*J. J. Simpson*), in the British Museum (Natural History) fits Malloch's description perfectly, but for the sexual characters. Curran does not mention

whether his remarks have been gathered from Malloch's description, or whether he has seen specimens, but he lists no localities, a fact which would seem to support the former assumption.

The male, which has not been described, has the pollinosity of the frons pale yellowish white, the mesonotum ferruginous behind and pale ferruginous in front of suture. The frons is almost one-fifth head-width in middle and only slightly wider at lunula and vertex, it is adorned with three strong inclinate setæ, alternating with three very fine ones, the two reclinate setæ are rather strong, the anterior of them slightly stronger. Hind femora with four *pv* setæ in basal half. The last section of *m* is one-fourth longer than the last but one. Otherwise Malloch's description of the female fits the male exactly.

*Dichæatomyia polita* Mall.

The Ashanti specimens mentioned by Malloch (1921, Ann. & Mag. Nat. Hist. (9) viii. p. 420) do not belong to this species, but are *liberia* Curr. (dark and pale specimens) and *devia* Curr. The only specimens known are therefore the typical ones from KENYA: Aberdare Mts., two of which are in the British Museum.

*Dichæatomyia neavei*, sp. n., ♀.

*Length* 6.3 mm., of wings 6.1 mm.

*Head* rufous-brown, parafrontalia and occiput (but for median part) mauve-brown, not very densely whitish dusted. Eyes virtually bare. Frons strongly narrowed to vertex; sides of face almost straight, hardly more strongly diverging below antennæ than sides of frons, but somewhat concave towards lower margins of eyes; parafrontalia somewhat narrowed from fore end to middle, where they are one-fifth as wide as the interfrontalia, with one strong and two small inclinate and two reclinate setæ and a few small hairs. Inner verticals and ocellars strong, outer verticals rather strong (verticals judged from pores), postverticals rather fine. Antennæ mauve-brown, reddish near base of arista, third joint thrice as long as wide, slightly exceeding mouth-margin, but falling short of level of lower eye-margins by half its width; arista long-plumose, almost as wide in middle,



including plumosity, as the third antennal joint is long. Parafacialia less than half, jowls as wide as third antennal joint. Palpi brownish orange.

*Thorax* rufous to mauve-brown, with an orange-brown suffusion in front, which reaches the *prst* laterally and the first *post dc* posteriorly; not very densely white-dusted, a pair of shining paramedian vittæ to the inner side of the *dc* of almost even width and about as wide as the three adjacent dusted vittæ, the sublateral shining vittæ wider, constricted at suture, dilated and longitudinally divided behind it, scutellum inconspicuously and evenly dusted. *acr* hair-like, in 6-7 irregular rows; *prsc acr* and *prsc ia* rather long, though not very strong, half as long as the first *prst dc*, which is almost two-thirds as long as the second; two strong *post dc*, the first of which is as distant from the suture as from the second, a small third *post dc* in front of them; two humerals, the upper one much smaller, one *ph*, one much stronger *prst*, two *npl*, the second somewhat weaker than the first but stronger than the *pra*; anterior *ia* fine, posterior *ia* moderately strong, one very strong and one small *sa*, two post-alars, the posterior (interior) one very strong; scutellum setulose on dorsal surface, with the normal two pairs of strong setæ, a distinct subbasal lateral, and a preapical discal. Anterior propleural and lower prostigmatal small, curved upward, posterior propleural rather small, upper prostigmatal moderately strong, some hairs adjacent; mesopleura with 3+1 strong and one fine seta on hind margin, and a small seta opposite the first *npl*, otherwise setulose; 1+2 *stpl*, the posterior one much stronger, the other two subequal.

*Abdomen* oval, pointed at apex, blackish piceous, the base somewhat brownish, the apex narrowly and not very conspicuously ferruginous; evenly covered with not very dense grey pollinosity. Second segment with a row of rather numerous marginal setæ, which are fine on dorsal surface and stronger and more erect on lateral surface, third segment with 1-2 lateral discals and four marginals on either side, fourth with four discals and two marginals on either side.

*Legs* pale testaceous. Fore femora with a *d*, *pd*, and *pv* row of about eight rather strong setæ, which decrease in length from base to apex, fore tibiæ with a strong submedian *p* seta, a strong *d* and *pv*, and a smaller *pd* apical

spur; (mid-legs missing in type); hind femora with an *ad* (almost *d*) row of 13 short setae, an *av* row of six rather fine though moderately long setae, the last of which is stronger, two *pv* in basal half, one *pd* and one *d* (slightly *pd*) preapical, hind tibiae with an *ad* seta at middle, a very small *pd* at the same level, and two rather fine *av* slightly beyond it.

*Wings* brownish hyaline, the veins light brown.  $r_1$  ending somewhat beyond level of  $r-m$ , the latter just before middle of discal cell,  $r_{4+5}$  and  $m$  slightly converging at apex,  $m$  very slightly bent towards  $r_{4+5}$ . Calyptrae brownish hyaline, border and fringe pale brown, lower calyptra strongly projecting. Halteres orange-yellow.

NYASALAND: Mt. Mlanje, 26. viii. 13 (*S. A. Neave*), ♀ type.

*Dichaetomyia somereni*, sp. n., ♂♀.

*Length* 5.6–6.7 mm., of wings 5.8–6.5 mm.

♂. *Head* fuscous, pollinosity brown, except on anterior two-fifths of parafrontalia and upper half of parafacialia, where it is silver-white, and on face, where it is brownish grey. Eyes with sparse very short hairs. Frons one-seventh to one-eighth head width in middle, moderately widened to fore and hind ends, sides of face almost straight, strongly diverging to lower margins of eyes, which are separated by three-fifths of the head width parafrontalia half as wide behind lunula as interfrontalia, narrowed to middle, very narrow but of even width from there to vertex, with 3–4 pairs of inclinate setae, 1–2 inclinate setulae, and two reclinate setae, the anterior of which is very small. Inner verticals distinct but small, outer verticals hardly distinguishable from the occipital row, postverticals not much smaller, ocellars strong. Antennae fuscous, with brown pollinosity, third joint thrice as long as wide, reaching mouth-margin and slightly exceeding level of lower margin of eyes; arista long-plumose, as wide, including plumosity, as the third antennal joint is long. Parafacialia not quite one-half, jaws one-and-a-half times as wide as the third antennal joint. Palpi fuscous.

*Thorax* black with three rather broad vittae of greyish pollinosity, the latter is denser and only slightly brownish at front end, and becomes sparser and gradually brown

behind suture, the vittæ much more conspicuous in anterior half of presutural part; the paramedian pair of undusted black vittæ narrow in front, but twice as wide behind suture, the sublateral undusted vittæ very broad, indistinctly divided by a narrow vitta of dust from *prst* to suture, rather broadly divided behind suture by a dusted vitta along the *ia*. *acr* hair-like, in 6-7 irregular rows; *prec acr* and *prec ia* rather long, at least as long as the first *prst dc*, which is about one-third as long as the second; two very weak and two strong *post dc*, the first of the latter slightly more distant from suture than from the second; two humerals, the upper one half as long as the lower, one *ph*, one strong *prst*, two *npl*, the second of which is somewhat weaker than the first, but about twice as long as the *pra*, anterior *ia* small, posterior one rather long, one very strong and one rather small *sa*, two post-alars, the posterior one stronger; scutellum setulose on dorsal and lateral surfaces to the lower edge, with the normal two pairs of strong setæ and a small subbasal lateral seta. Anterior propleural and upper prostigmatal strong, mesopleura with 3+1 strong and a few fine long setæ on hind margin, and a rather small seta opposite the first *npl*, otherwise setulose; 1+2 *stpl*, the posterior one much stronger, the lower somewhat weaker than the anterior.

*Abdomen* oval, truncate at apex, glossy black with slight bluish reflections, thinly and evenly covered with brownish inconspicuous dust. Second segment on either side with 1-2 discals and three strong marginals towards and on the lateral surface, a few weak marginals between the two groups, third with three strong discals and three strong marginals, the latter approaching the median part, fourth with 3-4 strong discals and marginals.

*Legs* fuscous with pale reddish brown tibiæ and tarsi and infuscated apex of the latter. Fore femora with 9-10 *d*, *pd* and *pv* setæ, which are rather strong, but only the last few of which are long, fore tibiæ with a strong submedian *p* seta, the *pd* apical spur as strong as the *pv* but somewhat shorter than the *d*; mid-femora with a small *ad* and *pd* (almost *d*) and a strong *pd* and *p* preapical, mid-tibiæ with two *pd* setæ; hind femora with about 14 short *ad* (almost *d*) setæ, a strong *av* seta at apical fifth or sixth, about three weaker ones shortly

before and a few small ones beyond it and in basal half, *pv* surface with a few stronger setulæ only near apex, hind tibiæ with two very small *pd*, one rather strong *ad* somewhat beyond middle and two finer *av* about level with and shortly beyond it.

*Wings* conspicuously browned, the veins brown.  $r_1$  ending level with  $r-m$ , the latter distinctly beyond middle of discal cell,  $r_{4+5}$  and  $m$  distinctly converging at apex,  $m$  markedly bent forward. Calyptræ brownish hyaline with brownish border and fringe, the lower one strongly projecting. Halteres fuscous.

♀. Frons two-fifths head width, slightly narrowed to vertex, parafrontalia one-fourth as wide as interfrontalia before middle, with numerous fine proclinate hairs and the setæ stronger than in male. Sides of face somewhat concave in outline from level of arista to lower margin of eyes. Inner verticals strong, outer verticals rather fine though very distinct. Abdomen more broadly oval and more pointed at apex.

KENYA: Nairobi, vii. 30 (*van Someren*), ♂ type, 3 ♂ paratypes, 2 ♀ paratypes, three of the paratypes in coll. *van Someren*.

*Dichastomyia defectiva*, sp. n., ♀.

Length 6.7 mm., of wings 6.8 mm.

*Head* fuscous, face pale reddish, parafacialia and anterior part of parafrontalia with silver-white pollinosity, otherwise thinly grey-dusted. Eyes with very short and sparse hairs. Frons rather strongly narrowed to vertex, slightly more than one-third head width anteriorly, somewhat more than one-fourth at vertex; sides of face moderately diverging, slightly and almost evenly concave from base of antennæ to lower margin of eyes; parafrontalia slightly narrowed from anterior end to middle, where they are one-third as wide as the interfrontalia, with one strong and two small inclinate, and one very small and one strong reclinate seta. Inner verticals strong, outer verticals and ocellars rather strong, post-verticals conspicuous. Antennæ pale ferruginous, the third joint, which is largely browned, large, twice as long as wide, reaching mouth-margin, which is level with lower margin of eyes; arista long-plumose (apparently somewhat less wide, including plumosity, than the third

antennal joint is long). Parafacialia less than one-third, jowls less than once, the width of the third antennal joint. Palpi pale brownish orange.

*Thorax* testaceous, with a not very conspicuous brownish longitudinal suffusion between the *dc*, evenly and thinly covered with inconspicuous yellowish dust, *acr* hair-like, rather erect, in about eight irregular rows, *prec* absent; *prsc ia* fine, 2+3 very strong *dc*, the first *post* one much nearer to suture than to the second, two humerals, the upper one small, one *ph*, one very strong *prst*, one strong and one moderately strong *npl*, the *pra* distinctly shorter than the latter, the two *ia*, the posterior *sa*, and the anterior post-alar moderately strong, the anterior *sa* and the posterior post-alar very strong; scutellum setulose on dorsal surface, with the normal two pairs of strong setæ, a conspicuous subbasal lateral and three preapical discals, the second of which is as strong as the subbasal lateral. Anterior propleural and lower prostigmatal very small, curved upward, posterior propleural and upper prostigmatal rather small, the prostigmata with some adjacent hairs; mesopleura with several strong setæ on hind margin and a small seta opposite the first *npl*, otherwise setulose; 1+2 strong *stpl*, the posterior one longer, the lower one slightly shorter than the anterior *stpl*.

*Abdomen* broadly oval, almost circular in outline, pointed at apex, testaceous, a narrow hind margin of the second segment, the third segment but for its anterior angles, and the entire fourth segment piceous, rather shining and only thinly covered with brownish pollinosity. Second segment with a small lateral discal, a strong lateral, a moderately strong sublateral, and two pairs of rather weak paramedian marginals, third with about three discals at sides and a marginal row, consisting of 3-4 pairs of setæ, fourth with two pairs of discals and one pair of paramedian marginals on dorsal surface.

*Legs* testaceous, tarsi strongly infusate (the femora of the type hav a brownish streak along dorsal and ventral surfaces, but this is apparently caused by musculature that has become greasy). Fore femora with about nine not very strong setæ in the *av*, *pd*, and *d* rows, fore tibiae with a strong *p* seta somewhat before middle, the *pd* and *pv* apical spurs subequal, slightly smaller than the *d* apical

spur ; mid-femora with a smaller *ad*, and three stronger *p* (*pd*—almost *d*,—*pd* and *p*) preapicals, mid-tibiae with three rather strong *pd* setae ; hind femora with an *ad* (almost *d*) row of about nine not very strong setae, an *ad*, *d*, and *pd* preapical, about seven rather long *av* setae, which are fine but for the last 2–3, four fine but rather long *pv* from base to beyond middle, and a few shorter ones near apex, hind tibiae without distinct *pd* setae, with 2–3 *ad*, the first of which is rather strong and inserted slightly before middle, and with two *av* setae, the first of which is fine and inserted at the level of the strongest *ad*.

*Wings* brownish hyaline, the basal half somewhat paler, the veins dark brown.  $r_1$  ending level with  $r-m$ , which lies distinctly beyond middle of discal cell,  $r_{4+5}$  and  $m$  not converging towards apex,  $m$  shortly bent up at apex, and  $r_{4+5}$  almost equally upcurved. Calyptres luteous-hyaline. border and fringe brown, especially of the lower one, which projects strongly. Halteres dull brownish-red.

KENYA : Londiani, v. 36 (*H. J. A. Turner*), ♀ type.

*Dichæatomyia deceptiva*, sp. n., ♂.

Length 5.3 mm., of wings 5.8 mm.

*Head* pale testaceous, with the larger upper part of the occiput infuscate, pollinosity yellowish white, interfrontalia pale ferruginous. Eyes almost bare, subcontiguous. Frons one-twentieth head-width above middle, rather strongly widened to fore end, sides of face almost straight and even slightly convex opposite apex of second antennal joint, shortly concave at lower margins of eyes, which are separated by somewhat more than half the head-width ; interfrontalia almost linear behind the middle, parafrontalia very narrow, with three (and two hair-like) pairs of inclinate setae and, near ocelli, two pairs of very small reclinate setulae, the anterior of which is minute. Inner and outer verticals rather indistinct, postverticals only slightly shorter, ocellars strong. Antennae yellowish orange, the third joint somewhat paler and mat through pale-yellow pollinosity, somewhat more than twice as long as wide, slightly passing level of lower eye-margins, but not quite reaching mouth-margin ; arista long-plumose, almost as wide, including plumosity, as the third antennal joint is long. Parafacialia less than a

third, jowls as wide as third antennal joint. Palpi yellowish orange.

*Thorax* pale ferruginous, glossy, with thin whitish-yellow pollinosity and a broad, dark brown median vitta almost from neck to apex of scutellum, which reaches the inner border of the usual undusted vitta to the inner side of the *prst dc*, gradually widens towards suture, and more suddenly widens behind the first *post dc*, so that it passes exteriorly the two other *post dc*; on the scutellum it passes slightly the strong setæ; the pollinosity more distinct on the dark vittæ. *acr* hair-like, in 5-7 irregular rows, absent on a narrow strip along the inner side of the *prst dc*; *prsc acr* and *prsc ia* long though rather fine, at least half as long as the anterior *prst dc*, which is somewhat shorter than the very strong posterior one; three very strong *post dc*; two humerals, one *ph*, second *npl* and anterior post-alar moderately strong, first *npl* somewhat stronger; *prst*, anterior *sa*, posterior post-alar and two pairs of scutellars very strong; two *ia*, posterior *sa*, subbasal lateral and two pairs of preapical discals on scutellum not very strong though very conspicuous, sides of scutellum bare; *pra* much shorter than the second *npl*. Anterior propleural rather fine, situated below the posterior one, lower prostigmatal very fine, curved upward, posterior propleural and upper prostigmatal moderately long, mesopleura with 2+1 strong and a few moderately strong setæ at hind margin, and a small seta opposite the first *npl*, otherwise setulose; 1+2 *stpl*, the posterior one very strong, the other two strong.

*Abdomen* shortly oval, glossy, with thin yellowish pollinosity, the basal two segments testaceous, the first with a very narrow brown hind margin, the second with a complete median vitta and a complete, somewhat irregularly-defined dark brown band along hind margin, third and fourth segments entirely dark brown. Second segment with a small lateral discal, a few erect setæ on lower part of lateral surface, and two lateral marginals on either side, third segment with two lateral discals and three marginals on either side, fourth with a discal and a marginal row, each consisting of three pairs of setæ.

*Legs* pale testaceous, the tarsi strongly infusate, but less so at base, the femora with a brown spot on dorsum

of apical quarter or fifth. Fore femora with about eight setæ in the *d*, *pd*, and *pv* rows, fore tibiæ with a strong submedian *p* seta, the *pd* and *pv* apical spurs subequal, slightly shorter than the *d* one; mid-femora with a rather small *ad* and *pd* (almost *d*) and a rather strong *pd* and *p* preapical, and four long *pv* setæ in basal half, mid-tibiæ with two *pd* setæ; hind femora with four fine *pv* setæ in basal two-thirds and five small ones at apex, nine *av*, nine *ad* (almost *d*) setæ, one *pd* and two *d* preapicals (behind each other), hind tibiæ with a very small *pd* seta at three-fifths, a strong *ad* in middle and two rather fine *av*, the proximal one level with the *ad*.

*Wings* hyaline, pale, with brown veins and the following brown suffusions: one along the apical part of  $r_1$ , fused with a narrow one of the same length on the adjacent part of  $r_{2+3}$ , one along the apical part of each  $r_{2+3}$  and  $r_{4+5}$  (less dark), beginning at the level of *m-m*, which is strongly suffused as well as *r-m*, and a very indistinct suffusion on the apex of *m*.  $r_1$  ending hardly beyond level of *r-m*, which lies at almost three-thirds of discal cell,  $r_{4+5}$  and *m* slightly converging before apex, subparallel at apex, *m* not distinctly curved up. Calyptre brownish hyaline, with brown border and fringe, the lower one strongly projecting. Halteres pale orange-yellow.

S. RHODESIA: Vumba Mts., iii. 35 (*A. Cuthbertson*), ♂ type.

This species is utterly similar to *D. (Panaga) vumbana*, sp. n., which occurs at the same locality, and with which the type was mixed up, bearing the same number 4089. In *vumbana*, however, *r-m* and the base of  $r_{2+3}$  are not suffused, the *pra* is stronger than the second *npl*, etc.

*Dichæatomyia suffusa*, sp. n., ♀.

Length 7.1 mm., of wings 7.5 mm.

*Head* fuscous, face dull yellowish, the upper part of the parafrontalia and the occiput thinly greyish dusted, the jowls thinly brownish dusted, and the face and lower part of the parafrontalia silver-white dusted. Eyes with very short and sparse hairs. Frons distinctly narrowed to vertex, one-third head-width in front, more than one-fourth head-width at vertex; sides of face moderately diverging, slightly and almost evenly convex from arista



to lower margin of eyes; parafrontalia narrowed from anterior end to middle, where they are one-fourth the width of the interfrontalia, with one strong and 2-3 small inclinate and one rather small and one strong reclinate seta. Inner verticals and ocellars strong, outer verticals and postverticals moderately strong, very conspicuous. Antennae pale ferruginous, the third joint largely browned, almost two-and-a-half times as long as wide, not quite reaching mouth-margin, which is slightly above level of lower eye-margins; arista long-plumose, almost as wide, including plumosity, as the third antennal joint is long. Parafacialia not quite one-third, jowls as wide as third antennal joint. Palpi orange.

*Thorax* pale ferruginous, disc of mesonotum somewhat more brownish, with a pair of very inconspicuous yellowish-dusted vittae along the *dc*, and the lateral parts inconspicuously dusted. *acr* hair-like, in 4-5 irregular rows before suture, but in about ten behind it, *prsc acr* rather long, *prsc ia* fine, 2+3 strong *dc*, the first *post dc* nearer to suture than to the second, two humerals, one *ph*, one very strong *prst*, one strong and one moderately strong *npl*, the *pra* considerably longer than the second *npl*, two moderately strong *ia* (besides the *prsc ia*), second *sa* distinctly finer than they, anterior *sa* very strong, anterior post-alar rather strong, posterior one very strong; scutellum setulose on dorsal surface, with two pairs of very strong setae, a rather fine subbasal lateral and three preapical discals. Anterior propleural and lower prostigmatal fine, curved upward, posterior propleural and upper prostigmatal moderately strong, with a few adjacent hairs. Mesopleura with 3+1 strong setae and a few longer setulose hairs at hind margin, and a fine seta opposite the first *npl*, otherwise setulose; 1+2 *stpl*, the posterior one very strong, the other two rather strong, subequal.

*Abdomen* oval, moderately pointed at apex, first segment brownish testaceous but for a small transverse brown spot in middle of hind margin, second segment with a broad piceous-brown suffusion on median half from base to apex and a piceous-brown band on hind margin, third and fourth entirely piceous. Third segment with a marginal row of 4-5 setae on either side, fourth with a transverse row of about six rather small discals, apex with some rather fine marginals.

*Legs* testaceous, only the last three tarsal joints browned. Fore femora with about eight not very strong setæ in the *av*, *pd*, and *d* rows, fore tibiæ with two rather strong *p* setæ: one at two-fifths, the other at two-thirds; the *pd* and *pv* apical spurs subequal, slightly smaller than the *d* apical spur; mid-femora with 3-4 short and fine *pv* setæ in basal half, a rather small *ad* and *pd* (almost *d*) and a stronger *pd* and *p* preapical, mid-tibiæ with two rather strong *pd* setæ; hind femora with an *ad* row of twelve not very strong setæ and a *pd* preapical, about 8-9 *av* setæ, only the last but one of which is rather strong, and two rather fine *pv* setæ near base, hind tibiæ with a very small *pd* at three-fifths, a strong *ad* near middle, and two fine *av* setæ level with and slightly beyond the *ad*.

*Wings* brownish hyaline, the base pale reddish orange, apex of *C*<sub>2</sub> and the entire *Sc* brown, *r*<sub>2+3</sub> with a strong brown suffusion from slightly beyond the tip of *sc* to apex, only a narrow streak of *R*<sub>1</sub> along costa remaining pale, *r*<sub>4+5</sub>, *m-m*, and apical section of *m* similarly but less conspicuously suffused. *r*<sub>1</sub> ending beyond level of *r-m*, the latter just beyond middle of discal cell, *r*<sub>4+5</sub> and *m* shortly and slightly but distinctly upcurved at apex, subparallel shortly before apex. Calyptræ testaceous-hyaline, the lower one with the border and fringe largely brown. Halteres dull reddish.

NATAL: National Park, iii. 32 (Miss A. Mackie), ♀ type.

(To be continued.)

LVII.—*New Species of Ants (Hym., Formicidæ) from the Gold Coast, Borneo, Celebes, New Guinea and New Hebrides.* By HORACE DONISTHORPE, F.Z.S., F.R.E.S., &c., Department of Entomology, British Museum (Natural History).

#### Subfamily DORYLINÆ.

#### Tribe ECITINI.

#### *Enictus (Enictus) bidentatus*, sp. n.

♂.—Reddish yellow, thorax darker, pedicel, gaster, antennæ and legs lighter, more yellow, smooth and shining, except epinotum, which is slightly rugosely

punctured; clothed with sparse yellow outstanding hairs.

*Head* slightly longer than broad, broadest a little before centre, sides rounded, narrowed in front and behind, posterior angles bluntly rounded, posterior border truncate; *mandibles* narrow, curved, when shut enclosing a considerable space between inner border and clypeus, very feebly longitudinally striate, masticatory border armed with two blunt teeth at apex (including the apical tooth) and a longer, more pointed tooth towards base; *clypeus* very narrow, anterior border margined and armed in centre with two small, short, sharp teeth; *frontal carinæ* narrow, curved round antennal foveæ, and fused together at base; *antennal foveæ* large, round, deep; *eyes* wanting; *antennæ* 10-jointed; *scape* only reaching slightly beyond centre of head, thickened to apex; *funiculus* with joints 4-8 transverse, last joint pointed, longer than the two preceding taken together. *Thorax* longer than broad, narrowed at *meso-epinotal* suture, which is distinctly impressed; *pro-mesonotal* suture wanting; *epinotum* with dorsal surface considerably longer than the declivity, epinotal angle very distinct, margined; *declivity* short, abrupt; *petiole* and *post-petiole* with nodes rounded above, of about equal breadth, the former longer than the latter, longer than broad, armed beneath with a blunt tooth or projection, pointing forwards, the latter about as broad as long, armed beneath anteriorly with a shorter, more pointed tooth; *gaster* oval, rather short; *sting* very narrow.

*Long.* 3 mm.

Described from seven workers. Gold Coast, E. P. Tafo, ix. 1940; ex cocoa. No. 1352. G. S. Cotterell.

Type in B.M. (N.H.).

Santschi has described three species of *Ænictus* based on male specimens:—*Æ. asperivalvus*, ♂, Rev. Zool. Afric. vii. p. 233 (1919); *Æ. foreli*, ♂ (l. c. p. 234), and *Æ. mutatus* Sants., subsp. *pudicus*, ♂ (l. c.), from the Ivory Coast. The above-described species may, of course, eventually prove to be the worker of one of these.

It is unfortunate that Shuckard based his genus *Ænictus* on a male ant (Ann. & Mag. Nat. Hist. v. p. 266 (1840)).

The first worker of this genus to be described was *laeviceps*

Smith (Journ. Linn. Soc. Lond. ii. p. 279 (1857)), from Borneo. Smith, however, created the genus *Typhlatta* (l. c.) for its reception. This genus was sunk, as a synonym of *Ænictus*, but Wheeler (Journ. New York Ent. Soc. xxxviii. p. 198 (1930)) resuscitated it as a subgenus of *Ænictus* for the reception of those species with workers characterized by the pale coloration of the posterior corners of the head, and females like those of *laeviceps* Smith and *martini* Forel. These extraordinary females he described for the first time in 1930 (l. c. pp. 200 & 203).

Subfamily *PONERINÆ*.

Tribe *ECTATOMMINI*.

*Rhytidoponera* (*Rhytidoponera*) *gagates* Donisthorpe,  
subsp. *waigeuensis*, subsp. n.

♂.—This subspecies differs from the typical form from Japen Island in being a little smaller, more reddish in colour, the legs and antennæ being entirely red; the 10th-joint of the funiculus of the antennæ is not longer than the 9th, the striæ on the first two segments of the gaster are considerably more impressed and those on the post-petiole much more curved, and the tooth beneath the peduncle is a little longer and sharper.

Described from 19 workers taken by Miss L. E. Cheesman, Dutch New Guinea, Waigeu, Camp Nok, 2500 ft. One among dead leaves near river, March, 1938, Tube 15; one running about on foliage with other ants, April, 1938, and 12 by casual collecting, May, 1938, Tube 48.

Type in B.M. (N.H.).

*Diacamma rugosum* Le Guil, subsp. *waigeuensis*, subsp. n.

♂.—Very similar in appearance, colour, structure, outstanding hairs, etc., to the typical form.

The head is slightly broader and shorter, and less narrowed in front and behind. The sculpture of the prothorax, however, is quite different. The deep grooves are transverse at apex, becoming gradually more and more curved to base. The concave sides of the curved grooves being uppermost.

Long. 12.5 mm.

Described from two workers taken by Miss L. E. Cheesman, N. Dutch New Guinea, Waigau, Camp Nok, 2500 ft., v. 1938. With other ants, on low herbage.

Type in B.M. (N.H.).

Tribe LEPTOGENYINI.

*Leptogenys (Leptogenys) walkeri*, sp. n.

♀.—Black, shining, clypeus, mandibles, legs and apex of gaster red, central portion of femora brownish red; clothed with sparse outstanding yellow hairs.

*Head* from apex of clypeus slightly longer than broad, broader in front than behind, posterior angles rounded, posterior border slightly excised and narrowly margined; sculpture coarse, rugose, consisting of large round shallow punctures, enclosed by narrow raised ridges forming striæ in front; *mandibles* slightly longer than side of head, narrow, evenly curved, smooth and shining, masticatory border very narrow, armed with a long pointed tooth at apex and a very short blunt tooth at base, inner border furnished with a sharp ridge above; *clypeus* projecting anteriorly, angularly pointed at apex, sides parallel, with a sharp narrow carina in centre, continued between frontal carinæ; *frontal carinæ* short with well-developed lobes; *eyes* round-oval, large, prominent; *antennæ* long, 12-jointed; *scapes* extending beyond posterior angles of head by about  $\frac{1}{2}$  of their length; *funiculus* with 2nd joint longer than 1st and 3rd joints, 4–10 subequal, last joint about as long as the two preceding taken together. *Thorax* longer than broad, narrowed in middle; *pronotum* narrowed at apex to form a neck, which is transversely striate, disc convex, rounded at sides, sculpture consisting of shallow round scattered punctures; *pro-mesonotal furrow* distinct; *mesonotum* small, round, slightly convex, with punctures similar to those of pronotum but more sparse; *meso-epinotal furrow* well marked, narrow, longitudinally striate; *epinotum* considerably longer than broad, much more coarsely punctured than the rest of thorax, considerably longer than declivity, gradually rounded to *declivity*, which is transversely striate. *Node of petiole* high, with similar puncturation to that of pronotum, narrowed in front, rounded at sides, posterior surface truncate,

smooth, in profile considerably higher than long; *gaster* oblong, oval, broader than thorax, first segment broader than those following, sparsely punctured, constriction between first and second segments well marked, second segment more sparsely punctured than first.

*Long.* 6 mm., with mandibles 6.5 mm.

Described from a single worker: "Port Fila, Efate Is., New Hebrides, August, 1900, J. J. W." "New Hebrides, J. J. Walker: 1904—168."

Type in B.M. (N.H.).

I have much pleasure in naming this ant in honour of my old friend the late Commander J. J. Walker, R.N.

This species appears to come nearest to *L. foreli* Mann, from the Solomons, but differs from it in colour and sculpture; also the head and thorax are not subopaque, but shining, etc. Emery, in the 'Genera Insectorum,' states that no species of *Leptogenys*, sens. str., occurs in Australia, but Forel described a large species, *L. sjöstedti*, from Queensland, in 1915, and Wheeler found another large species, *L. clarki* Wheeler, in Western Australia in 1931.

Species have been described from this part of the world from Engano Island, near Sumatra; Bismarck Archipelago, New Guinea; New Britain; the Solomons; and Hawaii.

*Leptogenys (Lobopelta) violacea*, sp. n.

♂.—Of a beautiful violet colour with coppery reflections, apex of clypeus, last ten joints of funiculus, last four joints of tarsi, articulations of antennæ and legs, trochanters, spurs, and sting reddish yellow. Body shining, clothed with a few outstanding yellow hairs which are longer towards apex of *gaster*.

*Head* finely longitudinally striate throughout, subquadrate, slightly broader in front, measuring from apex of clypeus to base of head about as long as broad, posterior angles rounded, posterior border truncate, narrowly margined; *mandibles* large, triangular, crossing at apex, no space in front of clypeus, armed with a strong pointed tooth at apex, masticatory border unarmed, finely striate, with a row of rather widely separated punctures along masticatory and inner borders; *clypeus* large, triangular, transverse, projecting in a blunt round point anteriorly;

*frontal carinæ* short, flat; *antennæ* 12-jointed; *scape* reaching beyond posterior border of head by about  $\frac{1}{4}$  of its length; *funiculus* pubescent, gradually thickened to apex, second joint longer than first and third, joints 3-10 subequal, last joint pointed, about as long as the two preceding taken together; *eyes* round-oval, very slightly convex. *Thorax* longer than broad, contracted at mesonotum, broadest across disc of pronotum, the whole dorsal surface is practically smooth and shining; under a high power very fine longitudinally striæ may be seen and some small scattered punctures; the sides of the mesothorax are transversely striate anteriorly and very finely longitudinally striate posteriorly, those of the epinotum are strongly longitudinally striate anteriorly, smooth in centre, and transversely striate posteriorly; *pronotum* provided with a neck, the anterior portion of which is very finely and closely transversely striate, forming a small diamond pattern, the posterior portion deeply and widely transversely striate, disc convex, rounded at sides, with a shallow central furrow; *promesonotal suture* narrow, margined; *mesonotum* round, convex; *meso-epinotal suture* shallow but distinct, longitudinally striate; *epinotum* long, high and convex before declivity, dorsal surface about twice as long as the latter, epinotal angle rounded but distinct, declivity flat, transversely striate. *Node* of *petiole* high, rather thick, smooth and shining, with a few small scattered shallow punctures, rounded above, considerably higher than long or broad, anterior surface slightly convex, posterior surface slightly concave; *gaster* long-oval, considerably narrowed at apex, smooth and shining, with a very few larger and smaller scattered punctures, constriction between first and second segments well marked; *sting* long, curved, sharply pointed.

*Long.* 9.5 mm.

Described from eight workers taken by Miss L. E. Cheesman, Dutch New Guinea, Waigau, Camp Nok, 2500 ft., May, 1938, Tube 38. "Nest inside rotten stump in old beetle burrows, heaps of frass below each entrance."

Type in B.M. (N.H.).

This beautiful species comes nearest to *Leptogenys* (*Lobopelta*) *purpurea* Emery and *L. (L.) chalybæa* Emery,

from New Guinea and Borneo, respectively. The former is a smaller and less robust insect; the colour of the head and thorax being chiefly metallic blue, with violet reflections; the gaster black. The head is more strongly striate and the entire thorax is striate.

The latter is a larger insect (12 mm.), and the colour is dark metallic blue. The striæ of the head are much stronger and the whole thorax is striate.

### Subfamily FORMICINÆ.

#### Tribe CAMPONOTINI.

##### *Polyrhachis (Myrma) bryanti*, sp. n.

♀.—Black, palpi yellow, tibiæ, base of femora, tip of antennæ, claws and spurs reddish; clothed with fine grey pubescence, and scattered, sparse, outstanding yellow hairs.

*Head*, seen from above, oval, longer than broad, posterior angles rounded, posterior border slightly sinuate on each side and projecting in middle; finely longitudinally striate, cheeks and temples somewhat rugose; *mandibles* triangular, smooth and shining—with some rather deep punctures towards apex, masticatory border armed with three rather strong pointed teeth; *clypeus* large, transverse, convex, carinate in middle, anterior border very slightly sinuate in centre; *frontal carinæ* with sharp raised edges, parallel behind, space between narrow; *eyes* large, round-oval, prominent; *antennæ* long; *scape* extending beyond posterior angles of head by about half its length; *funiculus* with all joints longer than broad, slightly thickened to apex, last joint pointed, not quite as long as the two preceding taken together. *Thorax* longer than broad, narrowed to base, dorsal surface slightly convex, margined at sides, very finely and faintly longitudinally striate; *pronotum* armed with two moderate, sharply-pointed spines, directed forwards and slightly outwards; *pro-mesonotal suture* narrow but distinct, deeply excised at sides; *mesonotum* transverse, anterior angles bluntly rounded, sides rounded to base, where the thorax is again somewhat deeply excised; *meso-epinotal suture* entirely wanting; *epinotum* transverse, not as broad as mesonotum, narrowed to base, angle between dorsal surface and declivity marked by a



finely-raised ridge, slightly sinuate on each side, terminating in a small bluntly-pointed denticle, *declivity* slightly concave, about as long as dorsal surface. *Scale of pedicel* thick, anterior surface convex, rounded, posterior surface less convex, superior margin narrowed to a sharp edge, arched, somewhat sharply pointed or dentate at sides; *gaster* short-oval, first segment very long, hollowed out in front for reception of scale.

*Long.* 6 mm.

Described from two workers taken by G. E. Bryant, Borneo: Mt. Matang, W. Sarawak, 1. xi. 1914. B.M. 1919—147.

Type in B.M. (N.H.).

This species comes nearest to *P. (M.) inermis* Smith, but the pronotal spines are a little shorter, and not so pointed outwards, the ridge on the epinotum is less marked and the denticles less sharp, the scale is thicker and less wide, and the side teeth blunter.

*Polyrhachis (Myrma) hosei*, sp. n.

♀.—The general description of *P. (M.) bryani* would do equally well for this species; the colour, sculpture, pubescence, etc., being the same. *P. (M.) hosei*, however, is a larger and more robust insect; the *clypeus* is not carinate; the *pronotal spines* are longer; the dorsal surface of the *epinotum* is longer, the angle between the dorsal surface and declivity is much less marked, and the finely-raised ridge between the same is wanting, only the small denticles at the sides being present. The *scale* has a somewhat wider arch.

*Long.* 7 mm.

Described from four workers, Borneo, "Santubong, Jan. 07, J. H." [J. Hose]. "This *Polyrhachis* has its nest at the base of an epiphyte, the walls of the nest being made of the intertwining roots of the plant, the interspaces being choked up with earth and humus."

Type in B.M. (N.H.).

*Polyrhachis (Myrma) inermis* Smith (Cat. Hym. Brit. Mus. vi. p. 68, pl. iv. figs. 25, 26 (1858)), Celebes; *P. (M.) orsyllus* Smith (Journ. Proc. Linn. Soc. Lond., Zool. vi. p. 39, pl. i. figs. 6 & 7 (1861)), Celebes, Ceram, Sumatra; *P. (M.) carbonarius* Smith (Journ. Proc. Linn. Soc. Lond., Zool. ii. p. 60 (1857)), Malacca; *P. (M.) bryanti*, sp. n., Borneo;

and *P. (M.) hosei*, sp. n., Borneo, form a small group in the subgenus *Myrma* Billberg in which the scale is not armed with spines, but is formed as in the subgenus *Aulacomyrma* Emery.

The longitudinal striæ on the head and thorax are considerably more strongly marked in *orsyllus* and *carbonarius* than in the other species. I am indebted to my friend Professor G. D. Hale Carpenter for kindly lending me the types of the two last-mentioned insects.

Some myrmecologists would possibly treat all these ants as subspecies of one of the older species; it seems to me, however, best to call them all species.

Emery (Gen. Ins. clxxxiii. p. 209 (1925)) places *carbonarius* under "Espèce Douteuse." It is, however, quite a good and distinct species of *Myrma*; not *Aulacomyrma*, as incorrectly given in Ann. & Mag. Nat. Hist. (S. 10) x. p. 445 (1932).

*Echinopla striata* Smith, Journ. Proc. Linn. Soc. Lond. ii. p. 80 (1857), ♀, Malacca, Sumatra, Borneo, Celebes, Ceram.

Type-locality: Malacca. Female not described.

♀.—Very similar to the ♀ in appearance, colour sculpture, and hairs. Black, with long outstanding black hairs. The posterior border of the head is broader and more distinctly margined, the posterior angles less rounded, and the striæ more distinct; mandibles more massive, more strongly toothed and more striate; frontal carinæ not so strongly raised at edges, space between wider and flatter; eyes larger; ocelli present. Thorax broader; pronotum with anterior border not so serrate, anterior angles more rounded, posterior portion of disc at centre transversely striate; mesonotum considerably more convex, a narrow, straight, smooth, flat space projects from the anterior border for a short distance towards the disc; epinotum flatter, transverse, broader; petiole with shorter spines at sides of node; gaster larger, longer, less globose.

Long. 8 mm.

Described from a dealated female. Celebes, ex. coll. Smith. Presented by Mrs. Farren White, 99.303.

Female type in B.M. (N.H.).

LVIII.—*Descriptions and Records of Bees.*—CLXXXVII.

By T. D. A. COCKERELL, University of Colorado.

*Nomia alberti*, sp. n.

♂.—Length about 8 mm., anterior wing 6.

Black, rather slender, the abdomen narrowed basally, but hardly claviform; tegulæ of the large type, but not excessively large, the boss very dark reddish, the margin broadly pale; legs slender and simple, the tarsi dusky reddish. In most respects this agrees with *N. nubilosa* Ckll., but it differs thus: dark cloud of wings much smaller, and not so dark, only slightly invading end of marginal cell (invading whole of marginal cell in *N. nubilosa*); lower part of basal nervure distinctly arched; face narrower; hair-bands of abdomen inconspicuous and reduced to sides; first tergite narrower, campanulate (very broad in *N. nubilosa*). The fourth sternite is densely covered with white tomentum, except the very broad anterior corners.

Belgian Congo: Albertville, Jan. 1919 (*R. Mayné*).  
Congo Museum.

*Nomia nubilosa*, sp. n.

♂.—Length 7 mm., anterior wing 6.

Rather slender, but abdomen not narrowed basally; black, with dusky reddish tarsi; anterior and hind wings with the apical portion strongly infuscated, stigma dusky reddish, nervures light brown. Face broad, densely covered with white hair; front and vertex dull; antennæ very long, the flagellum reddish beneath; mesonotum and scutellum entirely dull, scutellum unarmed; thorax above with thin dull white hair, more abundant on scutellum, and especially so on postscutellum, where it is long; metathorax dull, the basal part, before the truncation, short, without a distinct area; tegulæ of the large type, but not extremely large, pale reddish with a dark boss, rounded behind; basal nervure very straight, bent only at extreme lower end, falling a little short of nervulus; first recurrent nervure joining second submarginal cell in middle; legs simple and slender; abdomen dull, with the depressed hind margins of tergites polished, and with

rather broad apical bands of pale hair, broadly interrupted in middle on first two tergites ; no trace of basal bands.

Natal : Howick, March, 1901 (*J. P. O.*)

Received by British Museum, from J. F. Queckett, in 1902. In Strand's table falls nearest to *N. mionana* from Senegal, but the abdomen is not oval and the wings and tegulæ appear to differ. In my table of 1935, it runs to *N. kampalana* Ckll., but that differs by the clear red tarsi, the very large tegulæ, the paler wings, and other characters.

*Nomia arida*, sp. n.

♂. (type).—Length about 6.5 mm., anterior wing 4.4.

Black, with the legs light red, the greatly swollen hind femora with a black saddle above, and the apical part (more extensively below) cream-colour, the lower side, some distance from the end, with a small tooth ; hind tibiæ cream-coloured apically, with a large lateral extension ; basitarsi cream-colour. Face broad, densely covered with slightly yellowish hair ; antennæ very long, the rather swollen scape pale yellowish in front, the flagellum red, dusky above ; mesonotum and scutellum dull, with short fulvous pubescence, scutellum unarmed ; a white band at each side of scutellum, and postscutellum with white hair ; area of metathorax well defined, with fine longitudinal rugæ, the posterior face with some long hairs ; tegulæ small, pale reddish ; wings rather dusky hyaline, a little darker apically ; stigma small, pale brown, nervures brown ; abdomen rather broad, but not oval, the broad apical depressions, and base of first tergite broadly, covered with cinereous tomentum ; venter pale reddish, apically black or dusky, the fifth sternite with a V-shaped thickening.

♀.—Length about 6.8 mm.

Much more robust ; mandibles red with the base white ; labrum red ; face densely covered with cinereous hair ; scape long and slender ; flagellum short ; mesonotum shining, bordered all round with cinereous pubescence ; legs pale red, the femora more or less darkened above ; abdomen very broad, moderately shining.

♀.—Variety *a*. Abdomen entirely red. This may be the very briefly described *N. walkeri* Dalla Torre (*rufiventris* Walker).

Sudan : males labelled G. R. F. Medani, Aug. 25, 1926, on berseem (*Whitfield*), and Sept. 10, 1925, on cotton, (*Maccawi*). Females from Kodok, Aug. 22, 1929, on grass flowers (*M. M. Ismail*), three of the typical form and three of the variety, all with the same data.

This has all the appearance of a desert bee ; it may have to be called *N. walkeri*, but it is impossible to be sure of anything from Walker's short description, and I did not find the type in the British Museum. *N. rubribasis* Ckll. is allied, but considerably larger. The male shows affinity with *N. tricoloripes* Ckll.

*Nomia gossypii*, sp. n.

♂.—Length about 7.5 mm., anterior wing about 6.

Black, with the legs partly pale ; head broad ; face and front densely covered with greyish-white tomentum ; mandibles reddish ; antennæ moderately long, flagellum bright red beneath, dusky above ; vertex dull ; mesonotum moderately shining, finely punctured, with short yellowish hair, which is thin on part of sides and behind ; leaving a U-like mark, the base directed posteriorly ; scutellum densely covered with yellowish tomentum, but at each side of it is a white stripe ; metathorax hairy, leaving a sharply-defined black basal area, which is prolonged posteriorly to a sharp point ; tegulæ rather large, but of the small type, light red, dark in front ; wings clear hyaline, with a strong apical cloud, which reaches as far as the tip of the marginal cell ; stigma rather large, clear red ; nervures pale ; basal nervure meeting nervulus ; second submarginal cell rather broad, receiving recurrent nervure at middle ; knees red, as also anterior tibiæ in front, middle tibiæ at end and part of front ; tarsi pallid, the hind ones very long ; hind tibiæ with a strong dentiform angle some distance above the end ; abdomen broad, moderately narrowed at base, so that the first tergite, seen from above, forms an approximately equilateral triangle ; tergites moderately shining, with rather broad, conspicuous, even pale fulvescent bands, beginning with the first ; first tergite conspicuously hairy, second with thin pale hair at base ; sternites pale-margined, fourth with a patch of pale hair.

Sudan : Khartoum, on cotton flowers, Sept. 22, 1926 (H. W. Bedford).

In my manuscript table, this runs next to *N. betsilei* Saussure, from Madagascar, which has the hind tibiae yellow and light red.

In Strand's table, it runs nearest to *N. braunsiana* Friese, which has a quite different metathorax, and is otherwise different.

A specimen from Shambat, Nov. 15, 1926, collected by H. W. Bedford on berseem, has much less hair, but is apparently denuded, and the antennae are missing. The dark-tipped wings are exactly the same, but the abdomen is dull above, except the margins of tergites, and the hind tibiae are red in front. This may be a distinct species, and from the description it appears rather like *N. pallidicornis* Walker. *N. aleniana* Strand also has the dark spot at apex of the wing, but the abdomen is partly red, though said to be sometimes all black except the hind margins of tergites. The latter form, from Derema in German E. Africa, was named *N. derema* Strand. It is perhaps possible that this is *N. gossypii*. Probably it is a distinct species, but we cannot be sure about it without seeing the type.

*Nomia medani*, sp. n.

♂.—Length about 5·7 mm., anterior wing 4·7.

Black, with the tibiae red at ends, and the tarsi cream-colour ; mandibles and flagellum red, the antennae reaching as far as scutellum ; face broad, covered with clear white hair ; tubercles tipped with red ; mesonotum and scutellum moderately shining, the scutellum swollen, not distinctly binodose ; thorax with thin white hair, a distinct band along hind margin of mesonotum and on postscutellum ; metathorax shining, the rugose basal area broadly triangular ; tegulae small, pale red ; wings motley-hyaline ; stigma of moderate size, pale testaceous ; nervures colourless ; basal nervure arched, falling a little short of nervulus ; second submarginal cell higher than broad, receiving recurrent nervure at middle ; legs simple, hind femora robust ; abdomen moderately shining, with conspicuous but rather narrow white hair-bands on margins of tergites ; basal tergite broad.

Sudan : Wad Medani, swept from flowers, March 5, 1928 (H. B. Johnston).

A typical desert bee, smaller than *N. arida* Ckll., and easily distinguished by the dark scape and partly dark legs. It may be compared with *N. junodiella* Friese, which is much larger, with black mandibles.

*Nomia cinerascens* Smith.

Pondoland : Port St. John (*Turner*). Nyasaland : Chiromo (*R. C. Wood*).

*Nomia odontostoma* Cockerell.

Belgian Congo : in addition to the type, females were taken by Michael Bequaert at Elisabethville, April 29, 1920, and Lubumbashi, May 2, 1921.

*Nomia laticinctula* Cockerell.

S. W. Africa : Okahandja, females, Dec., Jan., Feb. (*Turner*).

*Nomia speculina*, sp. n.

♂. (type).—Length about 10.5 mm., anterior wing 8.5.

Black, the antennæ entirely black, except that the flagellum is red beneath at apex, the legs black, with the tarsi light yellow, the hairy hind tibiæ obscurely pallid at base and apex ; hind legs simple, the femora not enlarged ; face broad, densely covered with white hair ; mandibles black ; vertex dull, shining close to lateral ocelli ; thorax with dull white hair, abundant at sides, but mesonotum and scutellum exposed and highly polished, with strong punctures ; the scutellum is densely punctured posteriorly, and is not bigibbous ; area of metathorax a transverse band, moderately enlarged in middle, with coarse rugæ ; posterior face of metathorax with long hair ; tegulæ not enlarged, black, with the anterior outer margin slightly pallid ; wings dusky, the outer margin darker ; stigma small, dusky reddish ; basal nervure meeting nervulus ; second submarginal cell broader than high, receiving recurrent nervure about middle ; abdomen moderately shining as seen from the side, dull as seen from above, the margins of the tergites pallid, with bands of white tomentum, on the first two tergites the white hair is only at sides, and the exposed margins of the tergites (the apical depressions) are highly polished ; apical plate very broad

and dark brown; sternites shining, the fourth binodose in middle. The tongue is long and slender.

♀.—More robust, the depressed margins of first two tergites rufous; apex of abdomen with white hair, stained with orange in middle. In Strand's table (1913) this female runs to *N. andrenimorpha* Strand, which is much smaller. In my table, published in 1935, it runs out at 36. In the Nyasaland fauna the male is known by the hind femora not enlarged, the exposed, shining, dorsum of thorax, and the dull first tergite. The female is known by the polished mesonotum and black tegulæ.

Nyasaland: Mlanje, 2 ♂, 3 ♀, Feb., March (*S. A. Neave*).

*Nomia dominarum* Cockerell.

Two females were collected by R. J. Nel, at Lady Grey, Feb. 12, 1925.

The female is recognised by the rather thin hair of thorax above, varying from pale grey to fulvous; the area of metathorax forming a narrow transverse channel, not enlarged in middle; tegulæ shining dark brown, with a broad pale margin; face broad, with clear white hair; antennæ with a long scape and short thick black flagellum; wings dusky hyaline, not clouded at end; stigma small, dull reddish; second submarginal cell broad, receiving recurrent nervure far beyond middle; basal nervure arched near end; hind tibiæ very broad, red, blackish basally; middle and hind basitarsi red, the hind ones with a large black spot; abdomen with rather narrow white hair-bands, hair at apex red.

*Nomia vulpina* Gerstaecker.

Belgian Congo: Lualaba River, 2500–4000 ft., 1907, both sexes (*Neave*); Elisabethville, March, 1926, male (*M. Bequaert*); Kambove, Katanga, April 11, 1907 (*Neave*). N. Rhodesia: 24 miles up Kadue (*Silverlock*). Pondoland: Port St. John, March, 1924 (*Turner*).

*Nomia wambana* Cockerell.

Uganda: Kampala (*C. C. Gowdey*). Described from the Belgian Congo.



*Nomia basinitens*, sp. n.

♀.—Length about 11.3 mm., anterior wing about 8.5.

Robust, black, with the legs partly red; tongue very long and slender; mandibles black; face narrow, with slightly flavescent hair, which is dense at sides; vertex shining; antennæ long for a female, dusky red beneath, the long scape lighter red; mesonotum not covered with hair, feebly shining on disc, the notauli polished; scutellum dull, with thin flavescent hair; postscutellum densely tomentose; metathorax densely covered with felt-like flavescent tomentum, except the basal area, which has the form of a very narrow band, enlarged to a small triangular area in middle; tegulæ red, rather large, but not of the enlarged type; wings hyaline, with a dusky apical cloud; stigma large, dusky red, nervures pale brown; basal nervure strongly arched, not quite meeting nervulus; second submarginal cell rather large, but higher than broad, receiving recurrent nervure at apical corner; legs light red, the femora somewhat darker, hind tibiæ thickly clothed with flavescent hair; hind basitarsi very large and long; abdomen with the first tergite highly polished, with a copper-red apical band; tergites 2 to 4 with broad bands of fulvous tomentum, the surface under the bands coppery; second tergite shining; hair at apex pale.

Nyasaland: Mlanje, ten females taken by S. A. Neave, 1912–1914, in January, February, April and May. In Strand's table this runs to *N. katonana* Strand, which is smaller and otherwise different. There is some resemblance to *N. tricinata* Friese and *N. perornata* Ckll., but no very close affinity. *N. tricinata* has the tegulæ with a black boss and hyaline margin, and the second submarginal cell is broad, receiving the recurrent nervure far from its end.

*Nomia angulifera* Cockerell.

S. W. Africa: Okahandja, 4 ♂, Dec. 1927, Jan., Feb. 1928 (*R. E. Turner*).

They agree with the description except that I do not see the pair of little red bosses on underside of abdomen, this doubtless due to the retraction of the segment. One

specimen has the abdominal bands light fulvous instead of white. The mandibles are broadly pale yellow at base.

*Nomia perornata* Cockerell.

Transvaal : Sterkfontein, both sexes (*A. P. Thomasset*).

*Nomia serratula* Smith.

Katanga : Lubumbashi, March 13, 1921, male with abdomen strongly blackened in middle (*M. Bequaert*).

*Nomia duplocincta* Sichel.

Sudan : Shambat, on berseem (*H. W. Bedford*) ; Dissa, on shatta (*Audas Bey*).

*Nomia stanleyi* Cockerell.

Gold Coast : Aburi (*W. H. Patterson*) ; Liberia : Moylakwelli (*Bequaert*).

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LIX.—*Descriptions of Four new Species of Terrestrial Isopoda from Zululand.* By WALTER E. COLLINGE, D.Sc.

*Cubaris gurjanovi*, sp. n.

Body ovate, strongly convex, tuberculated, with a large lateral tubercle on each side of the median line of the mesosome, first and second segments with 7-8 crescentic ribs laterally, less prominent on the remaining segments. Metasome finely granulose. Cephalon small, frontal line straight, slightly reflected, lateral lobes very small and ill-defined. Eyes large. Antennulæ very small, three-jointed. Antennæ short, flagellum two-jointed, proximal joint the smaller. First and second segments of the mesosome with notch and cleft, pleural plates slightly flattened, with raised dorsal rib and truncate terminations, last two segments produced backwardly in the mid-dorsal line in the form of a large tubercle. Telson wide, only slightly incurved laterally, truncate terminally, slightly raised in the mid-dorsal line. Uropoda with narrow basiopodite, exopodite median sized, cylindrical, articulating about the middle of the inner side of

the basiopodite, endopodite long, narrow and cylindrical, articulating with the inner anterior border of the basiopodite.

Length 8.5 mm.

Colour (in alcohol) yellowish grey.

*Habitat*.—Nr. Uhamos, Zululand, 1939.

*Type*.—In the author's collection.

I have pleasure in associating with this interesting species the name of Dr. Euphaxie Gurjanova, of Leningrad, the distinguished Russian carcinologist.

*Anchicubaris spinosus*, sp. n.

Body ovate, flattened, densely spinous, segments of the mesosome ribbed laterally and tuberculated in the centre. Cephalon small, frontal line slightly arcuate. Eyes small, laterally situated. Antennæ short, flagellum two-jointed, less than half the length of the last peduncular joint, proximal joint the smaller. Pleural plates of the mesosome discontinuous, variable terminations. Slight notch and groove on the underside of the first and second segments. First segment strongly reflected anteriorly, last two segments produced backwardly in the mid-dorsal line in the form of a large tubercle. Telson, anterior part triangular, then narrowing and almost square, slightly raised in the mid-dorsal line. Uropoda, basiopodite convex on the outer side, strongly incurved on the inner side, exopodite median sized, cylindrical, articulating about the middle of the inner side of the basiopodite, endopodite fairly long, cylindrical, articulating with the inner anterior border of the basiopodite.

Length 9.5 mm.

Colour (in alcohol) greyish-yellow, with few irregular dark brown blotches.

*Habitat*.—Nr. Uhamos, Zululand, 1939.

*Type*.—In the author's collection.

This species undoubtedly belongs to the genus *Anchicubaris* Cllge.\*, but it differs from the type of the genus *A. fongosiensis* Cllge. in the smaller cephalon, the strongly-marked sculpturing on the dorsal surface of the mesosomatic segments, the irregular terminations of the pleural plates and in the form of the telson and uropoda.

\* Ann. Natal Mus., 1920, iv. p. 484, pl. xxii. f. 89-96.

*Armadillidum virescens*, sp. n.

Body oblong oval, convex, nearly twice as long as broad, perfectly smooth dorsally, few tubercles on pleural plates. Cephalon with frontal lobe wide, straight, short and slightly reflected, lateral lobes small, overcurved laterally. Eyes fairly large, situated posterior lateral. Antennulæ small, three-jointed. Antennæ short, flagellum two-jointed, joints subequal. Pleural plates of the first five mesosomatic segments discontinuous. Telson broadly triangular with almost straight, wide terminal portion. Uropoda, basiopodite short, exopodite spatulate, broadly triangular, endopodite long, narrow and cylindrical.

Length 18.5 mm.  $\times$  9.5 mm.

Colour (in alcohol) uniform light olive-green.

*Habitat*.—Nr. Uhamos, Zululand, 1939.

*Type*.—In the author's collection.

The large size, the wide frontal lobe of the cephalon, the form of the lateral lobes and the telson and uropoda separates this species from any I am acquainted with.

*Pseudarmadillo rugosa*, sp. n.

Body ovate, convex. Cephalon with the frontal line wide and straight, no lateral lobes. Eyes small, compound, situated post-laterally. Antennulæ small. Antennæ short, flagellum two-jointed, proximal joint three or four times shorter than the distal one. Segments of the mesosome with two transverse rows of large tubercles on each, segments one and two with slight notch and cleft on the underside, the pleural plates of the first, second and third segments are curved upwards and the remainder slightly so. Metasome with smaller tubercles. Telson somewhat triangular, apex with a wide straight margin. Uropoda with narrow spatulate basiopodite, exopodite very small, articulating with the posterior inner side of the basiopodite, endopodite fairly long, articulating with the upper inner angle of the basiopodite.

Length 8 mm.

Colour (in alcohol) yellowish brown, with irregular darker brown mottling.

*Habitat*.—Nr. Uhamos, Zululand, 1939.

*Type*.—In the author's collection.

*P. rugosa* approaches in some respects *P. dollfusi* Richardson \*, but differs from that species in the form of the cephalon, telson and uropoda.

The genus *Cubaris* Brandt offers a wide field for research, containing as it does numerous widely differing forms distributed throughout the world, with many closely-allied genera, it presents a study of more than ordinary complexity.

As I have elsewhere pointed out †, "Brandt's description ‡, though brief, is quite clear, and the slight modifications suggested by Miers § in 1877 scarcely affect it. Budde-Lund ||, in his 'Revision,' p. 36 under the family Oniscidæ, subfamily 7, Oniscinæ, tribe 1, Armadilloidea, cites the genus *Armadillo* Dum. and under tribe 2, Oniscoidea, the genus *Armadillidium* Brandt, and from the later text we gather that the genus *Cubaris* is sunk as a synonym of *Armadillo*. In 1910 ¶ (p. 9), the genus is recognized and appears between *Armadillo* Dum. and *Pericephalus* B.-L., whilst in 1912 \*\*, it is recorded by him as a subgenus only, in the subfamily Oniscinæ."

The same author †† has suggested placing the South African species in the genus *Diploexochus* Brandt ‡‡. Brandt's description, however, is somewhat vague, and, in my opinion, would not help in clearing the situation. A much more comprehensive survey of the known species is necessary before any advancement will be made, together with a comparison with the species of allied genera; this alone will lead to a right understanding of the position of the genus and its relationship to others.

\* Isop. Nth. Amer., 1905, p. 657, fig. 700.

† Rec. Ind. Mus., 1916, xii. p. 117.

‡ Bull. Nat. Hist. Soc., Moscou, 1833, vi. pp. 171-193.

§ Proc. Zool. Soc. Lond., 1877, pp. 653-670, pl. 66-69.

|| Rev. Crust. Isop. Terr., 1904.

¶ Sjöstedts Kilimandjaro-Meru Exped., 21 Crust., 2 Isop., 1910.

\*\* Trans. Linn. Soc. Lond. (Zool.), 1912.

†† Op. cit.

‡‡ Op. cit.

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LX.—*Keys to the Muscidae of the Ethiopian Region :  
Dichæatomyia-group.* By F. I. VAN EMDEN (Imperial  
Institute of Entomology).

(Concluded from p. 701.)

*Dichæatomyia (Panaga) cuthbertsoni*, sp. n., ♂♀.

*Length* 7.0–7.5 mm., of wings 7.3–7.5 mm.

♂. *Head* fuscous, the interfacialia pale reddish translucent, pale yellowish-grey dusted, the parafrontalia and parafacialia silver-white dusted. Eyes with sparse short hairs, subcontiguous. Frons one-thirtieth to one-fortieth head-width in middle, slightly widened to vertex, where it is as wide as the ocellar tubercle, considerably widened anteriorly, sides of face almost straight, strongly diverging to lower margins of eyes, which are separated by more than half the head-width; parafrontalia almost linear, except in anterior third, where they are half as wide as the triangular interfrontalia, with 3–4 inclinate setæ and a few setulose hairs, reclinate setæ present in the shape of two very small hairs in front of the ocelli. Inner and outer verticals fine though quite distinct, ocellars not very strong. Antennæ orange, somewhat browned; third joint fuscous, except at base, two-and-a-half times as long as wide, falling short of mouth-margin by half its width and of level of lower eye-margins by almost its width; arista long-plumose, as wide, including

plumosity, as the third antennal joint is long. Parafacialia not quite one-half, jowls one-and-a-half times as wide as the third antennal joint. Palpi orange.

*Thorax* pale ferruginous with not very dense nor very conspicuous whitish-grey dust. The latter is interrupted to the inner side of the *dc* by a pair of narrow shining paramedian vittæ, which can in posterior view be traced to beyond the first *post dc*; a pair of less clearly-defined, but broader sublateral vittæ can be traced to the outer side of the *dc*. *acr* hair-like, rather long and fine, in about 11-12 irregular rows; *prsc acr* and *prsc ia* rather strong, almost one-half to almost two-thirds the length of the last *dc*; 2+3 very strong *dc*; upper humeral, second *npl*, second *sa*, two *ia*, and anterior post-alar rather strong, *prst*, first *npl*, anterior *sa*, posterior postalar and two pairs of scutellars very strong, *pra* moderately strong, distinctly shorter than the second *npl*; scutellum setulose on dorsal surface, with a pair of fine but rather long sub-basal laterals and 3-4 pairs of similar preapical discals. Anterior propleural and lower prostigmatal fine, curved upward, posterior propleural and upper prostigmatal rather strong, some yellowish hairs adjacent, mesopleura with 2+1 strong and two rather strong setæ at hind margin and one rather small seta opposite the first *npl*, otherwise setulose, the setulæ near upper margin black like those of the dorsal surface, the others yellow like those of the ventral surface; 1+2 *stpl*, the posterior one very strong, the anterior strong and the lower one rather strong.

*Abdomen* between heart-shaped and shortly oval, the basal two segments wholly pale ferruginous, the apical two entirely piceous-black. Each segment with several marginals and discals on and near lateral surface, on the second segment some weak marginals on the rest of the hind margin, on the third the marginals and on the fourth the discals more or less distinct, even near median line.

*Legs* testaceous, only the last three tarsal joints and the apex of the second infuscated. Fore femora with complete *d* and *pd* rows of 8-10 setæ and a *pv* row of 10-12 setæ, which are rather long and strong, fore tibiæ without setæ but for the *d*, *pd*, and *pv* apical spurs, the first of which is stronger than the two others, which are subequal; mid-femora with about ten rather long *pv* setæ from base to beyond middle and shorter ones from

there to apex, a rather small *ad* and *pd* (almost *d*) pre-apical, and a rather strong *pd* and *p* preapical, mid-tibiæ with two rather strong *pd* setæ; hind femora with about 14–16 setæ in the *ad*, *av*, and *pv* rows, those of the *ad* row rather short and strong, those of the *pv* row long and fine, those of the *av* row fine, except for 3–4 setæ near apex, one *d* and one *pd* preapical present, hind tibiæ with a strong *ad* seta near middle and an *av* not much beyond it, with or without a small *pd* seta.

*Wings* hyaline, slightly yellowish smoky, veins dark brown, paler near base.  $r_1$  ending not or slightly beyond level of  $r-m$ , the latter at almost three-fifths of discal cell,  $m-m$  rather strongly sinuate and oblique,  $r_{4+5}$  and  $m$  rather strongly diverging beyond  $m-m$ , subparallel before apex and both upcurved at apex,  $r_{4+5}$  more strongly so, so that they diverge at extreme apex. Calyptræ yellowish smoky with yellowish-brown border and brownish-golden fringe, lower calyptra strongly projecting. Halteres dull reddish-yellow.

♀. Very similar to male, but the hair much and the setæ somewhat shorter and stouter. Frons slightly more than one-third head-width anteriorly, slightly narrowed to vertex, interfrontalia somewhat widened to middle from both extremities, parafrontalia not quite one-third the width of the interfrontalia, with a few setulose hairs to the outer side of the inclinate setæ and with two rather strong reclinate setæ; inner verticals long and strong, outer verticals rather strong. Abdomen somewhat longer and more pointed than in male. The *pv* row of the fore femora consisting of 8–10 setæ, the mid-femora only with a row of slightly longer but half-appressed hairs along *pv* surface, hind femora without outstanding setæ on *av* and *pv* surfaces, except for 2–3 at apex of the former.  $m-m$  less sinuate and much less oblique,  $r-m$  not much beyond middle of discal cell.

S. RHODESIA: Inyanga, 30–31. i. 39, at bitter rot on apples (*A. Cuthbertson*), ♂ type, 2 ♂, 2 ♀ paratypes (1 ♂, 1 ♀ paratypes will be returned to Mr. Cuthbertson).

*Dichæatomyia* (*Panaga*) *crassirostris*, sp. n., ♂.

Length 7.2 mm., of wings 7.8 mm.

*Head* fuscous, with the face pale testaceous translucent, pollinosity whitish grey, silver-grey on parafacialia



and parafrontalia. Eyes with extremely short and sparse hairs, subcontiguous. Frons one-seventeenth head-width at middle, slightly widened to vertex and somewhat more to base of antennæ; sides of face straight, moderately diverging to lower margins of eyes, which are separated by three-fifths head-width; parafrontalia narrow, gradually becoming more so towards vertex, wider in front than the interfrontalia, which are only visible as a minute elongate triangle of the length of the ocellar tubercle, with three rather strong inclinate setæ and one setula on anterior third, and two very fine reclinate setulæ (the anterior one minute) in front of the ocelli. Inner and outer verticals indistinct, ocellars strong. Antennæ pale-yellowish orange, third joint more than two-and-a-half times as long as wide, reaching mouth-margin, but falling short of level of lower eye-margins by more than half its width; arista long-plumose, as wide, including plumosity, as the third antennal joint is long. Para-facialia one-third, jowls as wide as third antennal joint. Palpi pale orange.

*Thorax* pale ferruginous with inconspicuous, not very dense greyish-white dust, the paramedian vittæ slightly indicated only by the absence of *acr* hairs. *acr* hair-like, in about ten irregular rows, *prsc acr* and *prsc ia* rather long, almost half as long as the last *dc*; 2+3 very strong *dc*, the first of them somewhat weaker; *ph*, upper humeral, second *npl*, two *ia*, and posterior *sa* moderately strong, lower humeral, anterior *npl* and anterior postalar strong, *prst*, first *sa*, posterior post-alar and two pairs of scutellars very strong, *pra* very small, indistinct; scutellum setulose on dorsal and lateral surfaces down to the lower edge, subbasal lateral very conspicuous, almost half as long as the two pairs of strong setæ, 2-3 pairs of discal preapicals considerably smaller. Anterior propleural and lower prostigmatal fine, curved upward, posterior propleural and upper prostigmatal moderately strong, the prostigmatals surrounded by rather numerous black setulose hairs; mesopleura with 3+1 strong setæ and rather numerous fine setæ and erect setulose hairs along hind margin, and a conspicuous seta opposite the first *npl*, otherwise setulose; 1+2 *stpl*, the posterior one very strong, the other two strong, subequal.

*Abdomen* shortly oval, strongly rounded at sides and narrowly truncate at apex, pale ferruginous, the hind

angles of the third segment with a small piceous spot, those of the fourth with a broader one, the latter spots only rather narrowly separated in middle. Second segment with two rather strong discals and marginals at sides, and some fine appressed marginals on dorsal surface, third segment with two strong (and some weaker) discals at sides, and a row of seven strong erect marginals, fourth with a discal and marginal row of 6-7 strong erect setæ.

*Legs* pale testaceous, the tarsi brownish, especially towards apex. Fore femora with about ten *d* setæ, seven *pd*, the last 2-3 of which are stronger and approach the *d* row, and 9-10 strong *pv* setæ, the *p* and *pv* surfaces, moreover, with numerous erect rather long and strong hairs, fore tibiæ without a submedian seta, the *pd* apical spur distinctly smaller than the other two; mid-femora with a rather small *ad* and *pd* (almost *d*) and a stronger *pd* and *p* preapical, and with six rather strong and long *pv* setæ in basal three-fifths and about a dozen fine ones in apical two-fifths, above the latter there is a row of about six stronger setæ, which does not exceed the preapicals, mid-tibiæ with two strong and some small almost spiniform *pd* setæ; hind femora with about nine setæ in the *ad*, *av*, and *pv* rows, the ventral two rows much denser towards apex, one *pd* and two *d* preapicals, hind tibiæ with two small *pd*, one strong *ad* and 2-3 *av*, the proximal of which is smaller and level with the *ad*.

*Wings* brownish hyaline with brown veins, which turn ochreous to testaceous near base,  $r_1$  ending slightly beyond level of  $r-m$ , the latter at almost two-fifths of discal cell,  $m-m$  somewhat sigmoid and oblique,  $r_{4+5}$  and  $m$  slightly converging before and at apex.  $m$  very slightly upcurved at apex. Calyptræ ochreous-hyaline with pale ferruginous border and fringe, the lower one strongly projecting. Halteres pale reddish.

UGANDA: Burunga, 23. v. 26 (*G. L. R. Hancock*), ♂ type.

*Dichætomysia (Panaga) nebulosa*, sp. n., ♂.

Length 7.2 mm., of wings 7.5 mm.

*Head* fuscous, interfrontalia rufous, the face testaceous-translucent, pollinosity pale grey behind and below, yellowish white on face, pale golden-yellow on parafrontalia and parafacialia. Eyes with very short and

sparse hairs, virtually contiguous. Frons less than one-thirtieth head-width above middle, somewhat widened to vertex, where it is hardly wider than ocellar tubercle, somewhat more widened to lunula; sides of face straight, moderately diverging to lower margin of eyes, where it is not quite three-fifths head-width; parafrontalia almost linear, except in front, where they are almost as wide as the interfrontalia, which are only visible as a small elongate triangle of the length of the ocellar tubercle, with one strong and 3-4 fine inclinate setæ and, in front of the ocelli, two hardly traceable reclinate setulæ. Inner and outer verticals and postverticals fine but distinct, ocellars moderately strong. Antennæ light orange, third joint almost thrice as long as wide, almost reaching mouth-margin, but falling short of level of lower eye-margins by its width; arista long-plumose, as wide, including plumosity, as the third antennal joint is long. Parafacialia one-fourth, jowls almost one-and-a-half times as wide as third antennal joint. Palpi orange.

*Thorax* brownish testaceous, somewhat paler at shoulders and scutellum, covered with thin greyish-yellow dust, which is interrupted by a pair of very narrow vittæ to the inner side of the *dc* and of broad, but less clearly defined, vittæ to the outer side of the *dc*, the anterior extremity of the broad median dusted vitta more conspicuous than any other part of the pollinosity. *acr* hair-like, rather long, fine and erect, in about ten irregular rows, *prsc acr* and *prsc ia* rather long, the former more than half as long as the last *dc*; 2+3 strong *dc*, the first of them somewhat shorter; *ph*, upper humeral, second *npl*, two *ia* and anterior post-alar rather strong, lower humeral, first *npl*, *prst*, first *sa*, posterior post-alar and two pairs of scutellars very strong, *pra* and second *sa* moderately strong, conspicuously shorter than the second *npl*; scutellum setulose on dorsal surface and upper half and lower quarter of lateral surface, subbasal lateral slightly shorter than the second *npl*, the outer one of the 2-3 pairs of discal preapicals as long as the subbasal lateral. Anterior propleural and lower prostigmatal moderately fine, curved upward posterior propleural moderately, upper prostigmatal rather, strong, the latter surrounded by rather numerous black setulose hairs; mesopleura with 4+1 strong setæ and rather numerous

fine setæ, and erect setulose hairs along hind margin and 2-3 fine setæ opposite the first *npl*, otherwise setulose; 1+2 *stpl*, the posterior one very strong, the other two rather strong, subequal.

*Abdomen* somewhat shortly oval, narrowly truncate at apex, first segment testaceous, second testaceous with the apical quarter to third brown, the third and fourth piceous but for a narrow basal margin of the third. All the setæ rather fine, the second and third segments each with 1-2 lateral marginals at or towards sides, the third and fourth each with 1-2 lateral discals, the fourth also with a marginal row of about four pairs of setæ.

*Legs* pale testaceous, the tarsi piceous. Fore femora with a *d*, *pd*, and *pv* row of about eleven setæ, which become stronger towards apex and are longest in the *pv* row, fore tibiæ without a submedian seta (apical spurs lost); mid-femora with somewhat longer setulose hairs but no outstanding setæ along *av* and *pv* surfaces, *ad* and *pd* (almost *d*) preapicals rather small, *pd* and *p* preapicals strong, mid-tibiæ with two strong *pd* setæ; hind femora with 14-15 *ad* setæ, 1-2 fine *av* near base, and 3-4 rather strong ones at apex, about eight rather fine and not very long setæ at apex of *pv* surface, and a *d* and *pd* preapical, hind tibiæ with a rather indistinct small *pd* setula at three-fifths, a strong *ad* at middle, and two somewhat smaller *av*, the proximal of which is level with or somewhat beyond the *ad*.

*Wings* somewhat smoky with a large brown suffusion from apex of *sc* to apex of  $r_{4+5}$ , *r-m*, and *m-m*; veins dark brown with light brown bases.  $r_1$  ending somewhat beyond level of *r-m*, the latter at almost three-fifths of discal cell; *m-m* somewhat sigmoid and oblique,  $r_{4+5}$  and *m* hardly converging just before apex, both somewhat upcurved at apex, *m* slightly more so. Calyptre brownish hyaline with brown border and fringe, the lower one strongly projecting. Halteres dull yellowish brown.

S. RHODESIA: Mt. Selinda, xi.-xii. 36 (*R. H. R. Stevenson*), ♂ type. Sent for identification by Mr. Alex. Cuthbertson.

This species is very similar to *D.* (s. str.) *suffusa*, but in the latter the suffusion does not reach *r-m*, the fore tibiæ have two *p* setæ, the *pra* is much longer, and the infra-alar bulla is not setulose.

*Dichæatomyia (Panaga) gilvicornis*, sp. n., ♂.

*Length* 6.7 mm., of wings 6.8 mm.

*Head* fuscous, face testaceous translucent, jowls and interfrontalia brown translucent, pollinosity pale yellowish grey, but greyish white on the parafacialia and parafrontalia. Eyes with extremely short and sparse hairs, contiguous. Frons as wide at vertex as ocellar tubercle, linear near middle, somewhat more than one-fifth head-width at lunula; sides of face very slightly convex in outline above and slightly concave towards lower margin of eyes, where it is three-fifths head-width; parafrontalia linear, except in front, where they are slightly wider than the interfrontalia, which are only visible as a small elongate triangle of hardly the length of the ocellar tubercle, with one strong, two weaker, and 1-2 hair-like inclinate setæ and, in front of the ocelli, two minute reclinate setulæ. Inner and outer verticals fine but distinct, ocellars strong. Antennæ orange-yellow, third joint fully thrice as long as wide, falling short of mouth-margin by less than half its width; arista long-plumose, as wide, including plumosity, as the third antennal joint is long. Parafacialia hardly one-third, jowls slightly more than fully as wide as the third antennal joint. Palpi fuscous-brown.

*Thorax* pale ferruginous, with not very dense greyish-white dust, which is interrupted in front by a pair of inconspicuous narrow paramedian vittæ to the inner side of the *dc* and a broader spot around the *ph* and *prst*; the triangular sclerite beneath the infra-alar bulla piceous in apical half. *acr* hair-like, in about ten irregular rows, *prsc acr* and *prsc ia* rather strong, more than half as long as the last *dc* and as long as the first; 2+3 strong *dc*; *ph*, upper humeral, second *npl*, two *ia* and anterior post-alar rather strong (similar to the first *dc* and *prsc acr*), lower humeral and first *npl* strong, *prst*, first *sa*, posterior post-alar and two pairs of scutellars very strong, *pra* and second *sa* rather small, half as long as the second *npl*; scutellum setulose to lower edge (except at apex), sub-basal lateral and one pair of preapical discals not very strong, 2-3 other pairs of preapical discals rather fine. Anterior propleural and lower prostigmatal fine, curved upward, posterior propleural and upper prostigmatal

rather strong, prostigmata surrounded by rather numerous black setulose hairs; mesopleura with 3+1 strong setæ and some long setulose hairs along hind margin, and a moderately fine seta opposite the first *npl*, otherwise with black erect hairs; 1+2 *stpl*, the posterior very strong, the other two strong and subequal.

*Abdomen* subcircular-cordiform, testaceous, the apical half more brownish, the median and hind parts of the third and the whole of the fourth segment but for its anterior angles piceous-brown. Second segment with 2-3 indistinct, third and fourth with 3-4 distinct lateral discals, each segment with a row of distinct marginals towards sides, which are much stronger on the third and fourth segments, where they extend more or less to median line.

*Legs* pale testaceous, the tarsi conspicuously browned. Fore femora with ten setæ in the *d* and *pd* rows and with twelve in the *pv* row, fore tibiæ without a submedian seta, with a well-developed *d* and a minute *pv* apical spur; mid-femora with four rather long *pv* setæ in basal half, some fine *pv* setulæ near apex, a fringe of rather fine *p* (almost *pv*) setæ in apical half, a rather small *ad* and *pd* (almost *d*) preapical, and a strong *pd* and *p* preapical, mid-tibiæ with two rather strong *pd* setæ; hind femora with about 16 *ad* setæ, three *av* in basal half and 4-5 in apical half, two *pv* towards middle, two *d* and one *pd* preapical, hind tibiæ with an indistinct small *pd* seta at two-thirds, a rather strong *ad* in middle, and two rather fine *av* level with and somewhat beyond the *ad*.

*Wings* somewhat yellowish smoky, the anterior half more brownish smoky, with a brown suffusion from apex of *sc* to apex of  $r_{2+3}$ , which reaches posteriorly to halfway between  $r_{2+3}$  and  $r_{4+5}$ , and which begins posteriorly level with the apex of  $r_1$ ; veins brown with light brown bases.  $r_1$  ending very slightly beyond level of *r-m*, the latter at two-thirds of discal cell, *m-m* slightly oblique and somewhat sigmoid,  $r_{4+5}$  and *m* hardly converging shortly before apex, both very slightly upcurved at apex. Calyptre yellowish brown, the border and fringe largely brown, lower calyptre strongly projecting. Halteres dull yellowish brown.

SIERRA LEONE: Niala, 11. i. 33 (*E. Hargreaves*). ♂ type.

*Dichastomyia (Panaga) vumbana*, sp. n., ♂♀.

*Length* 5.8–7.0 mm., of wings 6.5–7.2 mm.

♂. *Head* brownish testaceous with the occiput and upper part of frons fuscous and the face and jowls testaceous translucent, interfrontalia rufous, pollinosity whitish, more silver-white on the parafacialia and parafrontalia. Eyes with very sparse and very short hairs, narrowly separated. Frons about one-fifteenth head-width behind middle, very slightly widened to vertex, where it is hardly wider than the ocellar tubercle, moderately widened to lunula, where it is one-sixth head-width; sides of face moderately diverging and straight almost to lower margin of eyes, which are separated by one-half head-width; parafrontalia narrow, somewhat more than half as wide in front as the interfrontalia, which are triangular in front, linear behind middle and elongate triangular towards ocellar tubercle, with one strong and 3–4 weak inclinate setæ and, in front of the ocelli, one minute and one quite conspicuous reclinate setula. Inner and outer verticals fine though rather distinct, ocellars strong. Antennæ pale orange, third joint slightly more than twice as long as wide, falling short of mouth-margin by half its width and of level of lower eye-margins by its width; arista long-plumose, wider, including plumosity, than the third antennal joint is long. Parafacialia one-fourth, jowls one and one-fourth the width of the third antennal joint. Palpi yellowish orange.

*Thorax* testaceous, dorsum more brownish testaceous with a brownish to dark brown median suffusion, which is narrower and less conspicuous in front, broadens behind and encroaches upon most of the dorsal surface of the scutellum; glossy, very inconspicuously dusted, the dust not visible in posterior view. *acr* fine, hair-like, sparse, in 5–7 irregular rows, *prsc acr* and *prsc ia* distinct but small, one-third to one-fourth the length of the last *dc*; 2 + 3 very strong *dc*; *ph*, upper humeral, second *npl*, and two *ia* not very strong, *pra* and anterior post-alar moderately strong, *prst*, lower humeral, first *npl*, first *sa*, posterior post-alar, and two pairs of scutellars very strong, second *sa* weak; scutellum rather sparsely setulose on dorsum, bare on sides, subbasal lateral not very strong, three pairs of preapical discals finer to fine. Anterior propleural and lower prostigmatal fine, curved upward, posterior propleural and upper prostigmatal moderately

long, the prostigmata with a few adjacent hairs, which are yellowish, as are almost all the hairs—but not the setæ—of the pleural and sternal plates; mesopleura with 3+1 strong and two fine long setæ along hind margin and a rather fine seta opposite the anterior *npl*, otherwise with rather numerous pale and single dark hairs; 1+2 *atpl*, the lower one only slightly more distant from the anterior than from the posterior one, the latter very strong, the other two rather strong and subequal.

*Abdomen* oblong-oval, rather broadly truncate at apex, first and second segments testaceous with a narrow brown hind margin, which on the second is triangularly widened on median line, third piceous-brown but for a small anterior corner, fourth entirely piceous. Second segment with two weak lateral discals, one rather strong lateral marginal and three pairs of weak marginals between them, third with two rather weak discals towards sides and three pairs of rather strong marginals, fourth with 4-5 pairs of discals, the sublateral ones placed closer to base than the lateral and paramedian ones, and three pairs of rather strong marginals.

*Legs* pale testaceous, the tarsi gradually infuscated from the apex of the first to the last joint. Fore femora with about eight setæ in the *d* and about ten in the *pd* and *pv* rows, fore tibiæ with a rather strong *p* submedian seta, the *d*, *pd*, and *pv* apical spurs slightly decreasing in length in this order; mid-femora with three longer setulose hairs in basal third, a rather weak *ad* and *pd* (almost *d*) and a strong *pd* and *p* preapical, mid-tibiæ with two moderately strong *pd*; hind femora with twelve moderately strong *ad* setæ, the last three of them less densely placed, 4-5 *av* at apex, which are fine, but for the last one, a row of about 15 rather long *pv* hairs, two *d* and one *pd* preapical, hind tibiæ with an inconspicuous *pd* at two-thirds, a strong *ad* at middle, and a somewhat weaker *av* shortly beyond it.

*Wings* slightly whitish opaque, with a dark brown suffusion along the apical part of,  $r_1$ , filling *Sc* but for a narrow whitish streak along the apical part of *sc*, a brown suffusion along apical part of  $r_{2+3}$ , beginning halfway between the apices of  $r_1$  and  $r_{2+3}$ , and a brown suffusion along *m-m*; veins brown in apical part, light brown to testaceous towards base.  $r_1$  ending level with, or slightly before *r-m*, the latter between middle and



three-fifths of discal cell,  $m-m$  almost straight and hardly oblique,  $r_{4+5}$  and  $m$  subparallel shortly before apex, both slightly and almost equally bent up at the tip. Calyptræ somewhat smoky, border brownish testaceous, fringe brownish golden, lower calyptra strongly projecting. Halteres testaceous-yellow.

♀. Frons one-third head-width in front, one-fourth at vertex, interfrontalia rather bright rufous-brown, somewhat dull and infusate behind, four times as wide as the parafrontalia, anterior reclinate seta fine, posterior one rather strong, inner vertical strong, outer vertical moderately strong; sides of face less diverging, the face hardly more than one-half head-width at lower margin of eyes. Third antennal joint very slightly tinged with brown, except at base. Abdomen more pointed to apex, the marginal band of the second segment somewhat wider and its median extension reaching base, third and fourth segments wholly piceous on dorsal surface. Hind femora without longer *pv* hairs.

S. RHODESIA: Vumba Mts., iii. 35 (*A. Cuthbertson*), ♂ type, 2 ♀ paratypes (one of the latter will be returned to Mr. Cuthbertson). Together with the types a very similar, but not closely-related, species has been collected; it has been described above as *D. (s. str.) deceptiva*, sp. n.

*Dichæatomyia (Panaga) hargreavesorum*, sp. n., ♀.

Length 6.8–7 mm., of wings 6.3–6.8 mm.

Head fuscous, frons somewhat reddish anteriorly, jowls and upper part of parafacialia brownish testaceous translucent, face whitish testaceous translucent, dust pale grey, whitish on interfacialia and parafrontalia, creamy to golden-white on parafacialia. Eyes with extremely short and sparse hairs. Frons slightly less than one-third head-width at lunula and somewhat more than one-third at vertex; sides of face moderately diverging and slightly concave, the face somewhat more than one-half head-width at level of lower eye-margins; parafrontalia slightly narrowed in anterior half, parallel-sided in posterior half, one-third to one-fourth the width of the interfrontalia in middle, with one strong and three weak inclinate and one weak and one strong reclinate seta, exteriorly with an irregular row of proclinate setulæ. Inner and outer verticals and ocellars strong, postverticals moderately strong. Antennæ orange, the third joint with a very

slight brownish tinge at apex and almost four times as long as wide, not quite reaching mouth-margin and level of lower eye-margin; arista long-plumose, as wide, including plumosity, as the third antennal joint is long. Parafacialia one-third as wide as, jowls slightly wider than third antennal joint. Palpi orange.

*Thorax* testaceous, mesonotum largely pale ferruginous, pollinosity not visible from behind, except for an oblong median spot behind neck. *acr* hair-like, rather short, in about 8-9 irregular longitudinal rows, *prsc acr* and *prsc ia* moderately strong, almost one-half as long as the last *dc*; the following setæ are very strong: 2+3 *dc* (the first of them somewhat weaker), the lower humeral, first *npl*, *prst*, anterior *sa*, posterior post-alar, and two scutellars; rather strong are: the upper humeral, *ph*, two *ia*, anterior post-alar, and—slightly shorter—the second *npl*; somewhat shorter than the latter, but quite conspicuous are: the *pra*, second *sa*, subbasal lateral and the outermost of the 3-4 pairs of preapical discals of the scutellum; the latter is setulose on dorsum and sides down to the lower edge. Anterior propleural and lower prostigmatal fine, curved upward, posterior propleural and upper prostigmatal moderately strong, surrounded by a few fine hairs. Mesopleura with one moderately strong and 2+1 strong setæ, two fine setæ and some setulose hairs on hind margin, and a not very long but very conspicuous seta opposite the first *npl*, otherwise setulose; 1+2 *stpl*, the posterior one very strong, the other two moderately strong, subequal.

*Abdomen* shortly oval, pointed at apex, wholly testaceous to pale ferruginous. First and second segments each with 1-3 stronger marginals towards the lateral surface, the other marginals very weak, second with a lateral discal, third with one lateral discal and a marginal row of three pairs of strong setæ, fourth with two strong discals and two strong marginals on either side.

*Legs* testaceous, tarsi infusate from the second joint onwards. Fore femora with 8-9 setæ in the *d*, *pd*, and *pv* rows, fore tibiæ with a rather strong submedian *p* seta, the *pd* apical spur markedly shorter than the *d* and *pv* spurs; mid-femora with two *pv* setæ in basal third, and a small *ad* and *pd* (almost *d*) and a stronger *pd* and *p* preapical, mid-tibiæ with two strong *pd* setæ; hind femora with about thirteen short *ad*, six long *av*, the last

two of which are conspicuously stronger, and the last three of which form a subapical group, three *pv* in basal half, one *d* and one *pd* preapical, hind tibiae with a small, but distinct *pd*, a strong *ad* and 1-2 not very strong *av* setae near middle.

*Wings* hyaline, slightly yellowish smoky, veins brown, becoming light brown and testaceous towards base.  $r_1$  ending well beyond level of  $r-m$ , the latter slightly before (type) or distinctly beyond middle of discal cell,  $r_{4+5}$  and  $m$  very slightly converging before apex, slightly diverging at tip,  $r_{4+5}$  being somewhat more strongly upcurved than  $m$ ;  $m-m$  slightly sinuate and rather steep. Calyptrae luteous-hyaline, border pale testaceous, fringe golden-yellow. Halteres dull yellowish.

UGANDA: Kawanda, P.R.S., 4. v. 39, ♀ type; Kampala, 30. i. 27 (*H. Hargreaves*), 1 ♀ paratype (returned to Mr. Hargreaves).

*Dichastomyia* (*Panaga*) *hargreavesorum nialana*, ssp. n., ♀.

A female specimen from SIERRA LEONE: Niala, 21. x. 30 (*E. Hargreaves*), has almost identical systematic characters, but the fore tibiae have a quite strong *ad* seta in middle and a small one at apical fourth. Otherwise the preceding description applies, with the following exceptions:—the third antennal joint is almost thrice as long as wide, and the arista, including plumosity, is slightly wider than the third antennal joint is long. The median dusted spot of the mesonotum reaches and indistinctly passes the suture, and there is also a pair of narrow dusted subdorsal vittae present along the outer side of the *prst dc*. The abdomen is slightly longer and narrowly truncate at apex. Only the apical one or two tarsal joints are infuscated; on the mid-femora two smaller *pv* setae are present in addition to those mentioned in *hargreavesorum*, s. str., one between and the other beyond the two stronger ones; on the hind femora the apical *av* group is identical, but in addition there is only one strong *av* seta present at basal third (and two very fine ones before and beyond it), the number of *pv* is only two, on the hind tibiae the small *pd* lies at the apical third. In the wings  $m-m$  is rather strongly sigmoid and oblique, and  $m$  is more strongly upcurved at apex.

These deviations, especially in the chetotaxy of the fore tibiae, are rather considerable for a subspecies, but

the forms are very similar and doubtlessly very closely related, so I think that they must represent the same species at their respective localities.

### PYRELLINA Mall.

The relations of this genus with the Muscinæ were discussed in British Museum Ruwenzori Exp. 1934-35, ii. pp. 51-52 (1939), and *Pyrellia chrysotelus* Walk. (= *anorufa* Villen.) was transferred to the present genus on p. 65 of that paper, though  $r_1$  is bare in it. The setulose  $r_1$  was regarded by Malloch as the outstanding character of *Pyrellina*, and the genus was therefore considered related with *Dasyphora*. The latter, however, has the lower calyptra of the Muscinæ. Séguy (1937, Gen. Ins. fasc. 205, p. 371) was apparently misled by Malloch's remarks on the similarity of the two genera, and included *Pyrellina* in his key in a group with hairy eyes, whereas actually all the species included in *Pyrellina* by Malloch have bare eyes. The hairiness of the eyes should, however, not be used as a generic character, and *P. chrysotelus* has very conspicuous and rather dense hairs.

- |   |                          |
|---|--------------------------|
| 1 (4). Dorsal surface of $r_1$ bare.  |                          |
| 2 (3). Eyes densely hairy. 2+4 strong <i>dc</i> , <i>prsc acr</i> strong. Anterior part of mesonotum with white dust (visible in posterior view), which is uniform and interrupted by a pair of very short and narrow bare vittæ only on anterior declivity. Body purplish blue, the apical half or third of the fourth abdominal segment orange. ( $r_1$ sometimes with single setulæ on ventral surface.) | <i>chrysotelus</i> Walk. |
| 3 (2). Eyes bare. 0+2 <i>dc</i> , <i>prsc acr</i> absent. Mesonotum without any dust. Head and thorax glossy purplish black, abdomen orange. ( <i>Morellia bicolor</i> Stein).  | <i>bicolor</i> Stein.    |
| 4 (1). Dorsal surface of $r_1$ setulose. Eyes bare. (2-3)+4 strong <i>dc</i> , <i>prsc acr</i> more or less strong.   |                          |
| 5 (6). Thorax and abdomen uniformly metallic blue-green to purplish blue, the former with the humeral region and the centre of dorsum white-dusted, thus with three white-dusted vittæ anteriorly. Legs fuscous to black. ( <i>unicolor</i> Mall., n. syn.)   | <i>distincta</i> Walk.   |
| 6 (5). Abdomen partly or wholly ferruginous to testaceous.  |                          |
| 7 (10). Fore and mid-femora piceous-brown to black. Scutellum wholly dark, strongly metallic. Dusted vittæ of   |                          |

thorax short, reaching to middle of presutural part, the dark vittæ, enclosed by them, are broad and not divided.

- 8 (9). Abdomen purplish blue with the fourth segment wholly or partly yellowish orange. Legs piceous to black ..... *ruficauda* Mall.
- 9 (8). Abdomen wholly yellowish orange. Femora dark brown to piceous, tibiæ often more or less reddish, hind femora often reddish yellow ..... *inventrix* Walk.
- 10 (7). All the femora reddish yellow. Scutellum translucent rufous or light brown. Lateral parts of thorax more or less fulvous or brownish translucent. Dusted central vitta of thorax reaching suture.
- 11 (12). Hind tibiæ without a subbasal *pd* seta. The two dark vittæ on anterior part of thorax not divided by pale dust (though occasionally by paler ground-colour). Basal part of second and apical part of fourth abdominal segment pale, posterior part of second to anterior part of fourth infuscated with metallic blue reflections, but the infuscation of the posterior part of the second and the anterior part of the third not very strong ..... *rhodesi* Mall.
- 12 (11). Hind tibiæ with a rather strong subbasal *pd* seta. The two dark vittæ on anterior part of thorax divided by a narrow vitta of whitish dust along the *dc*. Second to fourth abdominal segments wholly dark, strongly metallic blue-green ..... *versatilis* Villen.

### Corrigenda.

Dr. S. A. Neave informs me on the publication of the first part of this paper that *Neaveia* Mall. 1921 is pre-occupied by *Neaveia* Druce 1910. The remarks on pp. 676 and 680 show that *Neaveia* Mall. and *Dichæatomyia* Mall. are no longer very clearly distinct, now that forms like *D. latifrons* Mall. and *N. convergens* Emd. have become known. It is therefore hardly desirable to create a new name for *Neaveia* Mall., and I now synonymise it with *Dichæatomyia*. In the key to the latter genus a reference to the former had already been deemed necessary (p. 680, note †).

Dr. Neave and Miss R. Davenport also draw my attention to the fact that on p. 678, line 9, the number 776 has been misprinted 775.

P. 676, line 5, from below : Skin, should read Stein.

LXI.—*Carboniferous Palæoniscids from East Greenland.*

By J. A. MOY-THOMAS, M.A. (Department of Zoology and Comparative Anatomy, Oxford).

[Plate XII.]

*Introduction.*

CARBONIFEROUS Palæoniscids have never previously been described from East Greenland. A few fragments were noted by Nielsen (1932) from the Permo-Carboniferous, but it is not till the Permian that generically identifiable specimens were described by Aldinger (1937). The fishes which form the substance of this paper were collected on Danish Expeditions to Greenland by Dr. E. Nielsen in 1936, in Traill Island, and by Drs. H. Stauber and W. Bierther in 1938, in Scoresby Land. The material is the property of the Geological Survey of Denmark, but since Denmark has recently been taken under the protection of the German Reich the fossils have been deposited in the University Museum, Oxford, for the duration of the war.

Although the material is abundant, most of it is very fragmentary, and it has only been possible to describe two species in any great detail. Since both these forms are sufficiently different from known Palæoniscids, it seems probable that the entire fish fauna is also new. For this reason the fragmentary remains of other species have been described in the hope that further research may reveal a similar fauna elsewhere, which would be particularly interesting, as the exact date of these Carboniferous rocks is uncertain.

Before proceeding further I should like to take this opportunity of thanking Professor E. A. Stensiö, of Stockholm, for arranging to have the collection of fossils sent to me for description. I would also like to thank Dr. E. I. White, of the British Museum (Natural History), for much helpful advice and criticism, and Professor Goodrich for reading this manuscript. I am, however, especially indebted to Miss M. Bradley Dyne for her help in the preparation of this paper, particularly for taking the photographs from which the text-figures have been prepared.

*Description of the material.*(1) *WHITEICHTHYS*, gen. nov.

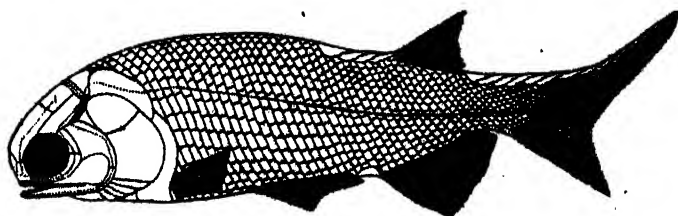
*Generic Definition.*—Body fusiform; the dorsal fin arising slightly behind the anterior margin of the anal; the dorsal fin small and acutely angulated, the anal being larger and obtusely angulated; the caudal fin heterocercal, inequilobate and not very deeply cleft; the pectoral fins small and situated low down on the body; the pelvic fins extremely long-based; all the fins are provided with unornamented, frequently jointed distally bifurcating lepidotrichia and with small fulcral scales on the anterior margins. The skull without a prominent rostrum; the orbit of moderate size; the suspensorium not very oblique; the opercular smaller than the subopercular; branchiostegals few in number; the expanded portion of the maxillary small and spatulate; the lower jaw narrow and tapering anteriorly; the teeth small and sharply pointed; the head bones ornamented with sparsely arranged well-defined tubercles; scales rhomboidal, those of the flank coarsely denticulated posteriorly, the more anterior flank-scales being also denticulated ventrally; the anterior flank scales ornamented with sharp backwardly-directed denticulations, the more posterior scales smooth.

Genotype.—*W. greenlandicus*, sp. nov.

*Whiteichthys greenlandicus*, sp. nov.

(Pl. XII. fig. A; text-figs. 1-3.)

Text-fig. 1.



*Whiteichthys greenlandicus*, gen. et sp. nov.

Restoration of the fish in lateral view.

*Specific Definition.*—Fishes not known to exceed 12 cm. in total body-length, the length of the head being con-

tained about  $4\frac{1}{2}$  times and the greatest depth of the body about 4 times in the total body-length.

*Material and Localities :—*

**North Scoresby Land.**

Mesters Vig. Lager 8. Profil 6. 1035M.

Pc3, Pc5, Pc10, Pc13, Pc16 (and counterpart Pc79), Pc41, Pc42AB, Pc44AB, Pc50, Pc51, Pc53, Pc54, Pc59AB, Pc75AB, Pc78AB, Pc82ABC, Pc83AB, Pc84, Pc85, Pc86, Pc87ABC, Pc92AB, Pc95AB.

Mesters Vig. Lager 9. Profil 1. 750M.

Pc22, Pc43a, Pc104, Pc133AB, Pc210, Pc211, Pc213AB, Pc214.

Mesters Vig. Lager 9. Profil 1. 45M.

Pc218, Pc231, Pc260AB.

Mesters Vig. Lager 9. Profil 1. No height known.  
Pc100AB.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 2.

Pc94, Pc101, Pc125, Pc225, Pc234, Pc263.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 3.

Pc58AB, Pc205, Pc206, Pc207..

Mesters Vig. Lager 9. Profil 2. Fossilhor. 4.

Pc1, Pc2, Pc25ABC, Pc33AB, Pc34AB, Pc70AB, Pc108, Pc136, Pc212, Pc253.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 5.

Pc167, Pc219.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 6.

Pc99AB, Pc100AB, Pc145, Pc151, Pc159, Pc162, Pc164AB (not cpts.), T73.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 7.

Pc45AB, Pc109, Pc161, Pc226AB.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 8.

Pc262AB.

Mesters Vig. Lager 10. Profil 1. Fossilhor. 2.

Pc55AB, Pc57AB.

Mesters Vig. Lager 10. Profil 1. Fossilhor. 3.

Pc235AB, Pc238AB.

Pc155AB.—No locality.

Skeldal Thomasbræ. Profil 2.

Pc195AB.

All collected by Bierther.



Schuchert River, W. Delta Gebiet, N.E. Bukt.

T21AB, T71, T72AB, T74.

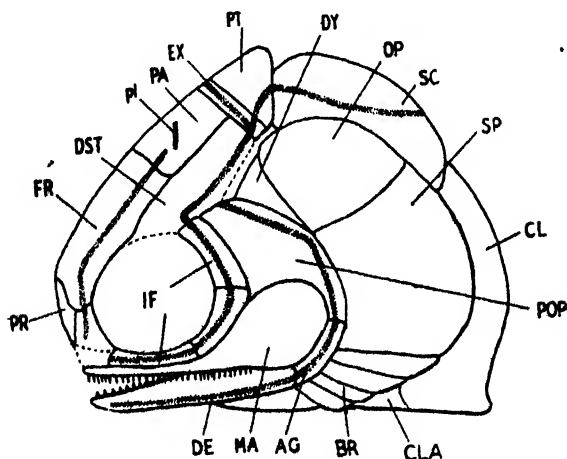
Collected by Stauber.

*Holotype*.—Head and anterior part of the body of a fish in counterpart, Pc42A & B. (Pl. XII. fig. A.)

*Description.*

a. *The skull.* (Text-fig. 2.)

Text-fig. 2.



*Whiteichthys greenlandicus*, gen. et sp. nov.

Restoration of the skull in lateral view.

The sensory canals are represented by dots.

AG = angular.  
BR = branchiostegal  
CL = cleithrum.  
CLA = clavicle.  
DE = dentary.  
DST = dermosphenotic and  
supratermporal.  
DY = dermohyal.  
EX = extrascapular.  
FR = frontal.

IF = infraorbitals.  
MA = maxillary.  
OP = opercular.  
PA = parietal.  
pl = pit-line.  
POP = preopercular.  
PR = postrostral.  
PT = post-temporal.  
SC = scapular.  
SP = subopercular.

The arrangements of the dermal bones of the skull, as far as can be determined, are restored in text-fig. 2.

In all the material the head is much crushed and the state of preservation so unsatisfactory that it has been impossible to interpret the structure of the endocranium.

The number of extrascapulars cannot be determined with certainty as they are always found in rather a frag-

mentary condition, the occipital commissure of the sensory canal system only being well preserved. However, there can be no doubt that they were narrow bones. The parietals are always well preserved, about as broad as they are long and half the length of the frontals. Both the frontals and parietals are relatively large bones and by far the largest bones in the skull-roof. The supratemporals and postfrontals are never very well preserved, their positions are indicated by the sensory canal, but their exact limits cannot be identified.

Although in many specimens the actual outline of the snout region is preserved, only traces remain of the bones forming it. It can, however, be said that the nasals were short bones enclosing between them a broad but rather short postrostral. No trace of nostrils can be seen. Although there appears to have been a rostral commissure of the sensory canal, this region is never well preserved.

Narrow infraorbitals were present, but there seems no doubt that suborbitals were absent. No sclerotic ring, hyomandibula, palatoquadrate or branchial arches are preserved.

The maxillary is of highly characteristic shape, with a spatulate expanded portion and very slender dentigerous anterior limb. Where fully preserved this slender part seems to extend very much further forward than the front end of the lower jaw. This, together with the fact that no separate tooth-bearing bone seems to be present in the snout region, was taken as an indication that the two maxillaries met in the middle line, although this could not actually be observed. Teeth are borne on the anterior limb and the frontal part of the expanded portion only.

The lower jaw is a slender structure and composed as far as can be seen of a dentary, an angular and a row of about four small tooth-bearing coronoids. The pre-articular and articular were not observed.

The ornamentation of these dermal bones is characteristic and consists of sparsely placed tubercles. On the bones of the cranial roof these tubercles are round, oval, or elongated. On the nasals, however, they are altogether coarser and the round type does not occur, the tubercles being elongated into short crescentic ridges. This type of ornamentation is found on all the other bones except the anterior part of the maxillary and possibly the dentary.

On the opercular and subopercular the tubercles are rather more sparsely arranged than on the other dermal bones.

Teeth are known on the maxillary and coronoids but not on the dentary. All the teeth are relatively long, slender and pointed, and situated very close to one another, although those of the lower jaw appear shorter and stouter than those of the upper.

The sensory canal system of the head is formed on the usual Palaeoniscid plan. The supraorbital canal does not extend very far into the parietal and the usual transverse pit-line lies at its posterior end. Anteriorly the supraorbital canal meets the infraorbital canal, and there seems to be every indication of the presence of a rostral commissure. The infraorbital, mandibular, and preopercular canals call for no special comment. No horizontal pit-line could be discerned on the cheek.

b. *The trunk and axial skeleton.*

The trunk is slenderly fusiform, the greatest depth of the body being a short distance behind the head and contained about four times in the total body-length. The axial skeleton is entirely unknown.

c. *The paired fins and their girdles.*

In the pectoral girdle the post-temporal is of normal more or less triangular shape, the supracleithrum is rather large and broad, and neither the cleithrum nor the clavicle require particular comment. The post-temporal is ornamented in the same way as the roofing bones of the skull, but the supracleithrum, cleithrum and clavicle bear longitudinal striæ, except for the ventral part of cleithrum which is ornamented with flattened tubercles.

The pectoral fins consist of about 15 or 16 much-jointed lepidotrichia, of which the seventh is the longest. The anterior margin of the fin has a few fulcra distally. The fin-rays, apart from the anterior ones, bifurcate distally in both the pectoral and pelvic fins.

The pelvic fins are exceptionally long-based and are set rather far forwards on the body, occupying most of the area between the pectoral and anal fins. The fin is formed of some 35-jointed lepidotrichia set at a very oblique angle to the body. The anterior margin of the fin is formed of 12 lepidotrichia, their distal ends alternating with fulcra.

d. *The unpaired fins.*

The lepidotrichia of the unpaired fins are unornamented and similar to those of the paired fins, bifurcating distally for only a short distance. However, it appears from some specimens that the lepidotrichia had a finely denticulated posterior margin, but in the majority of the material this is not obvious. The dorsal fin is small, acutely triangular and placed far back on the body. The fin is formed of about 23 lepidotrichia, of which the eighth is the longest. The anterior margin being similar to that of the pectoral fin.

The anal fin is long based, gently convex, and obtusely angulated, its anterior margin arising in front of that of the dorsal fin. The fin is formed of about 45 lepidotrichia, but its anterior margin is similar to that of the dorsal fin.

The caudal fin is heterocercal, inequilobate and only moderately deeply cleft with an acutely angulated ventral lobe, the margin of which is similar to those of the other unpaired fins.

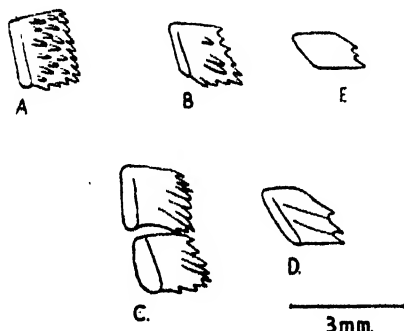
e. *Squamation.*

The general arrangement of the body-scales is of the characteristic Palæoniscid type. The scales are rhomboid, those on the flank directly behind the shoulder-girdle being decidedly deeper than broad. Four well-developed ridge-scales occur in front of the dorsal fin, a single one in front of the anal fin and a row extending from a point a short way behind the dorsal fin along the caudal pedicle to the tip of the tail. Two smaller ridge-scales lie in front of the ventral lobe of the caudal fin. With the exception of these last two, the ridge-scales are coarsely but infrequently serrated on their posterior edges.

Apart from their size the scales from different regions of the body can be distinguished by their ornamentation and can conveniently be divided into four types. The first type of ornamentation (text-fig. 3, A & B), which is found on the scales dorsal and ventral to the lateral line in the anterior region of the body, is very similar to that found on the head-bones. Each scale dorsal to the lateral line has a deeply denticulated posterior and ventral border, and bears striking spiky denticles lying more or less antero-posteriorly, which are more elongated than those of the roof-bones and merge into the marginal serrations, giving the scales a characteristic "shaggy" appearance.

There are usually about 8-10 of these spikes to a single dorsal scale. The scales in this region ventral to the lateral line have rather fewer spikes, but otherwise are similar. Further back on the body the denticles become fewer and fewer but the serrations remain, until in the region of the dorsal fin the second type of scales is found (text-fig. 3, C & D), in which both the posterior and ventral margins are strongly serrated, but the surface of the scale is smooth except for one or two shallow more or less longitudinal grooves. The third type (text-fig. 3, E) is

Text-fig. 3.



*Whiteichthys greenlandicus*, gen. et sp. nov.

A-E.—Scales from different regions of the body.

found in the region immediately posterior to the dorsal fin. Here the serrations are found only on the hinder margins and the surface is smooth. The fourth type of scale is found on the caudal pedicle and is diamond-shaped, smooth and unserrated. It must be remembered that these four types of scales are arbitrarily chosen and that every kind of intermediate stage exists.

*Remarks on the Genus WHITEICHTHYS.*—This genus can be distinguished from other described Palæoniscids by the position and relative sizes of the dorsal and anal fins, the very long based pelvic fins, the ornamentation of the head-bones and especially that of the scales, and the shape of the maxillary.

The genus is named in honour of Dr. E. I. White, who has contributed much to our knowledge of Carboniferous fishes.

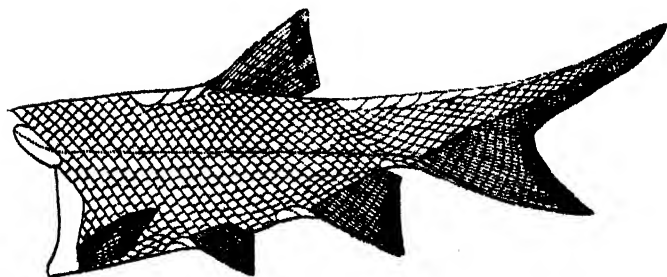
(2) *ALDINGERIA*, gen. nov.

*Generic Definition*.—Body fusiform; the dorsal fin arising opposite the middle of the pelvics; both dorsal and anal fins small, of much the same size and acutely angulated; the caudal fin heterocercal, inequibate and deeply cleft; the pectoral fins well developed and situated low down on the body; the pelvic fins short-based; all the fins formed of longitudinally striated, frequently jointed and distally dichotomising lepidotrichia, and with small fulcral scales on the anterior margin of the unpaired fins and probably also of the paired. The skull without a prominent rostrum, but only the maxillaries and lower jaws known in detail; the expanded portion of the maxillary rather small and rectangular; the lower jaw deep, with a much enlarged posterior end and its anterior part pointing downwards; the teeth well developed and conical; the bones of the skull-roof and lower jaw ornamented with closely set flat tubercles or short striæ, but those of the cheek apparently without ornament; the scales rhomboidal, those of the flank finely serrated posteriorly, unornamented or with fine longitudinal striæ, but the more posterior scales unornamented and unserrated.

Genotype.—*A. biertheri*, sp. nov.

*Aldingeria biertheri*, sp. nov.  
(Pl. XII. fig. B; text-figs. 4-6.)

Text-fig. 4.



*Aldingeria biertheri*, gen. et sp. nov.  
Restoration of the body in lateral view.

*Specific Definition*.—Fishes probably not exceeding 15 or 16 cm. in total body-length, the length of the head

being equal to the greatest depth of the body and contained about  $4\frac{1}{2}$  times in the total body-length.

*Material and Localities :—*

North Scoresby Land.

Mesters Vig. Lager 8. Profil 6. 1035M.  
Pc27.

Mesters Vig. Lager 9. Profil 1. 45M.  
Pc150A.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 2.  
Pc98, Pc138, Pc220AB, T55.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 3.  
Pc93.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 4.  
Pc30AB, Pc77AB, Pc156AB.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 5.  
T51.

Mesters Vig. Lager 9. Profil 2. Fossilhor. 6.  
Pc24, Pc53ABC, Pc144ABC, Pc203A.

Mesters Vig. Lager 10. Profil 1. Fossilhor. 2.  
Pc56B.

Mesters Vig. Lager 10. Profil 1. Fossilhor. 3.  
Pc61AB, Pc64, Pc65.

Skeldal Thomasbræ.

Pc66, Pc129, Pc130AB, Pc137, Pc139, Pc140,  
Pc145, Pc146, Pc168AB, Pc177AB, Pc178AB,  
Pc185, Pc186, Pc188AB, Pc194AB, Pc224, Pc247AB,  
Pc276AB.

No locality given.

Pc251, Pc259AB, T50AB.

All collected by Bierther.

Schuchert River, W. Delta Gebiet, N.E. Bukt.  
T52-T56.

Collected by Stauber.

*Holotype.*—Complete fish in counterpart, Pc129. (Pl. XII. fig. B.)

*Description.*

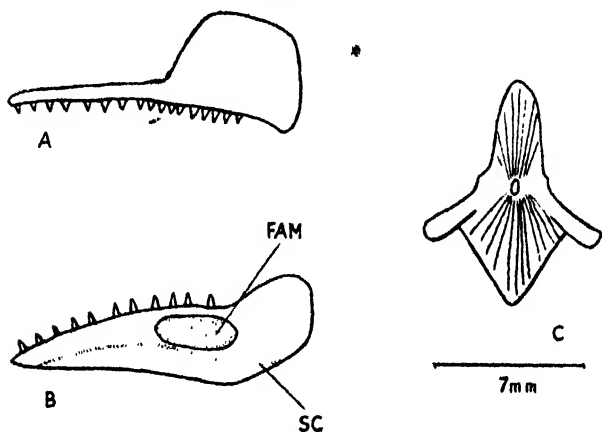
a. *The skull.*

Owing to the poor preservation it is not possible to give any detailed account of the dermal bones of the

skull or the endocranium, other than the maxillary, parasphenoid, to a certain extent the opercular and the bones of the lower jaw.

The parasphenoid (text-fig. 5, C) is broad and well developed. Its centre of growth is pierced by the hypophysial foramen. There appears to be only a single pair of ascending processes, directed postero-laterally from a point just behind the hypophysial foramen. The anterior median part of the bone in front of the hypophysial foramen is rather broad, but the posterior part, which is continued backwards quite a long way, is particularly broad.

Text-fig. 5.



*Aldingeria biertheri*, gen. et sp. nov.

A, Maxillary; B, lower jaw; C, parasphenoid.

FAM=Fossa for adductor mandibularis muscle; SC=Sensory canal.

The maxillary (text-fig. 5, A) is usually well preserved and is of a characteristic shape. The most striking feature is the very square appearance of the expanded part, which is relatively small for a Palaeoniscid, rectangular and only very slightly longer than broad. The anterior limb is rather narrow and forms nearly a right angle with the anterior margin of the posterior part. Teeth are borne along the entire ventral margin of the maxillary except at the extreme posterior end.

The only other bone which is satisfactorily preserved is the opercular. This bone is more or less rectangular and about as deep as broad.



The lower jaw (text-fig. 5, B) is, however, the most remarkable structure of the whole fish. Although it is very commonly preserved it is seen only from the outside, but can be prepared as a cast of the internal surface of the jaw. The most interesting features of the lower jaw are the well-developed high coronoid process, the downwardly turned anterior tooth-bearing end and the well-developed fossa for the mandibular adductor muscle (FAM.) The coronoid process is exceptionally well developed for a Palæoniscid and appears to be formed of a supra-angular distinct from the dentary, although the state of preservation makes it difficult to determine this point for certain. Likewise the presence of a separate angular is never clearly seen. The fossa for the adductor muscle is often well preserved as a cast. It is an oval fossa lying inside the posterior part of the dentary, just anterior to the beginning of the coronoid process. The dentary, which is particularly stoutly ossified, bears teeth from the coronoid process to its anterior end; these teeth are conical, well developed, and situated fairly close together.

The dermal bones of the roof are ornamented with small closely-set tubercles, many of which are elongated, mainly antero-posteriorly, into short ridges. The opercular and the maxillary are apparently without ornamentation. The dentary is unornamented except for a few antero-posteriorly directed ridges ventrally and a few pits in the smooth ganoine more dorsally.

The sensory canal is only known in the dentary, where it enters the bone at the posterior end beneath the coronoid process and is continued forwards anteriorly.

b. *The trunk and axial skeleton.*

The trunk is slenderly fusiform, the greatest depth of the body being contained about  $4\frac{1}{2}$  times in the total body-length. The axial skeleton is unknown.

c. *The paired fins and their girdles.*

In the pectoral girdle the post-temporal is of the usual more or less triangular shape, the supra-cleithrum relatively rather small and oval, and the cleithrum of the typical palæoniscid type, but rather upright and especially well ossified. The ornamentation of the bones of the pectoral girdle is essentially similar to that of the head-bones. The post-temporal is ornamented anteriorly by tubercles,

but posteriorly by short striæ. The supra-cleithrum is ornamented with irregular striæ running more or less parallel with the anterior and posterior margins. The cleithrum is ornamented on its exposed portion by long close-set ridges running more or less parallel with the long axis of the bone; the area below the insertion of the fin bears widely spaced and irregular short ridges and occasional tubercles.

The pectoral fin is seldom well preserved, it is carried low on the body and is relatively slender. The fin is formed of some eleven rays, of which the fifth is the longest. No fulcral scales were observed, but the state of preservation was never sufficiently good to be sure that they were not present in life. The first three lepidotrichia appear to be unjointed and do not bifurcate distally, as do the more posterior rays. Each lepidotrich, except a few anterior ones, is ornamented with four or sometimes five fine striæ parallel with the long axis (text-fig. 6, E). The number of striæ, however, tends to decrease distally.

The pelvic fin is small and not very long-based, and situated about half-way between the pectoral and anal fins. The fin is formed of about 16 rays, of which the fifth is the longest. No fulcra were observed on the anterior margin of the fin, but as in the case of the pectoral-fin, the preservation of this region is never good. The lepidotrichia are similar to those of the pectoral fin.

d. *The unpaired fins.*

All the lepidotrichia of the unpaired are similar in ornamentation and structure to those already described in the paired fins. The dorsal fin, although never really well preserved, appears to have been triangular with its apex acute. The fin is formed, of about 20 lepidotrichia, of which the fifth is the longest and its anterior margin has a number of well-developed fulcral scales.

The anal fin, which is usually well preserved, is much the same size as the dorsal fin and is formed of approximately 24 lepidotrichia, of which the fifth is the longest. It is more or less triangular with an acute apex, and its anterior margin bears fulcra.

The caudal fin is generally found in a good state of preservation. The axial lobe of the tail is long and

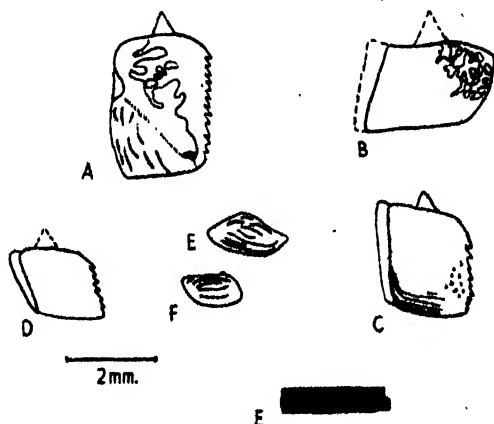
tapering and forms only a slight angle with the body. The fin is heterocercal, inequilobate and deeply cleft, and its anterior margin is formed of five rays, the distal ends of the three longest alternating with fulcra.

e. *Squamation*.

In general the scales are more ornamented on the dorsal and ventral parts of the body than on the flanks. Here, again, it is most convenient to describe the scales in arbitrarily selected groups, although each type can be found grading into the next.

The first type (text-fig. 6, A) to be described is found on the flank immediately behind the head and is orna-

Text-fig. 6.



*Aldingeria biertheri*, gen. et sp. nov.

A-F, scales from different regions of the body;  
E, ornamented lepidotrichia.

mented similarly to the roof-bones with irregularly arranged flattened ridges and tubercles. The hinder margin of these scales is finely denticulated.

The scales in the region of the pectoral fin (text-fig. 6, E & F) are peculiarly irregular in shape, some being almost diamond-shaped. They are ornamented with narrow curved ridges lying more or less antero-posteriorly, but tending to anastomose behind. These scales are not denticulated.

The majority of the flank-scales (text-fig. 6, C & D) are, however, more or less unornamented except for faint

striae in their bottom anterior corners, running parallel with the anterior and ventral margins. In most of the more anterior scales a patch of minute tubercles is found just in front of the posterior denticulations.

In the region of the base of the anal fin a few of a further type of scale (text-fig. 6, B) are found. In these scales the dorsal posterior corner is covered with flattened tubercles, and the hinder border is entire.

Finally, the caudal body-lobe has the usual diamond-shaped unornamented scales typical of most Palæoniscids.

Three ridge-scales are found in front of the dorsal, two in front of the pelvic and two in front of the anal and caudal fins. Ridge-scales also extend from a point a short distance behind the dorsal fin to the tip of the tail. The ridge-scales in front of the anal and caudal fins are rather smaller than the others and occasionally denticulated.

f. *Remarks on the genus ALDINGERIA.*

The shape of the maxillary and lower jaw, the relative size and position of the unpaired fins, and the ornamentation of the lepidotrichia are considered sufficient grounds for distinguishing this genus from other Palæoniscid genera. The name *Aldingeria* has been given in honour of Dr. H. Aldinger, who has so thoroughly described the Permian fishes of East Greenland. The specific name is in honour of Dr. Bierther, who collected the great majority of the material.

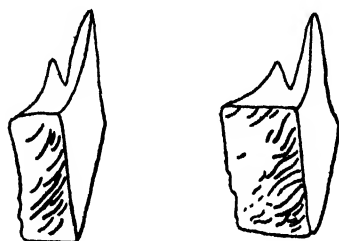
(3) OTHER PALÆONISCID TYPES.

In addition to the two Palæoniscids already described, numerous isolated bones and scales not referable to either genus are present in the collection. It has been considered advisable to give a short account of the more characteristic of these remains, especially of the maxillaries and scales, so that the fauna as a whole can be compared with those from other localities. No attempt, however, has been made to identify these fragments, even generically, because it has become increasingly clear from recent work on fossil fishes that such identifications are very unreliable and more or less valueless. It is therefore proposed only to refer to these fragments by letters for the time being, although it is hoped that

further and more complete material in the future may make fuller descriptions possible.

(i.) TYPE A. (Text-fig. 7.)

Text-fig. 7.



5 mm.

Scales of type A. T6BC.

*Material and Locality :—*

T6ABC.

Nedre Fiskhoris. Ravin II. Traill Island.

Collected by Nielsen.

*Description.*

The material consists of two isolated scales found in association. These two scales are strongly reminiscent of the *Acrolepis*-type, being thick with a fairly extensive covered area, which is produced upwards into a pointed process. The articular peg is also well developed. The posterior margin of the scales is not quite entire, having a few coarse serrations. The size of the exposed part varies in the two scales, but measures in the larger scale about 6 mm. in depth and 4 mm. in breadth. This region is only ornamented anteriorly, by irregular coarse diagonal striæ running from the anterior and dorsal margins towards the lower posterior corner.

(ii.) TYPE B. (Text-fig. 8.)

*Material and Localities :—*

Mesters Vig. Läger 9. Profil 1. 750M.

Pc91AB.

Mesters Vig. Läger 9. Profil 1. 45M.

Pc154AB.

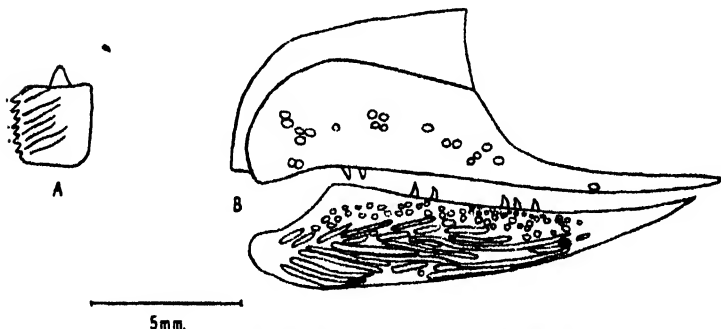
(Probably also Pc229.—No detailed locality.)

Collected by Bierther.

*Description.*

The material consists of a few dislocated bones and scales. The maxillary (text-fig. 8, B) has a long low expanded portion, the expanded margin of which slopes gradually downwards, forming a very obtuse angle with the anterior limb of the bone. As far as can be determined, the maxillary is ornamented exclusively with tubercles. The outline of the preopercular indicates a very oblique suspensorium and traces of tuberculated operculars and roofing-bones are also present.

Text-fig. 8.



A, scales; B, preopercular, maxillary and lower jaw. Pc 91A.

The dentary (text-fig. 8, B) is of the normal Palæoniscid shape, rather narrow posteriorly and tapering anteriorly. It is ornamented immediately below the tooth-bearing margin with flattened tubercles, but the remainder of the bone is ornamented with short striæ. Anteriorly these striæ are more or less parallel with the long axis of the bone, but posteriorly they converge to form a V. The teeth are of two sizes, medium-sized conical ones and smaller and finer ones.

The cleithrum and supracleithrum are striated longitudinally. The few fragments of lepidotrichia present are unornamented. The flank-scales are rhomboidal and

serrated posteriorly, some are smooth, while others have fine striæ running obliquely from the antero-dorsal corner. A similar kind of ornamentation is found on the more posterior scales, which are less serrated.

(iii.) TYPE C. (Text-fig. 9.)

*Material and Locality :—*

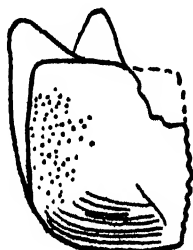
Mesters Vig. Läger 8. Profil 6. 1045M.

Pc10C.

Also Pc230. No detailed locality.

Collected by Bierther.

Text-fig. 9.



5mm.

Scale of type C. Pc230.

*Description.*

The material consists of single scales, the exposed area in the largest of which measures about 5 mm. in breadth by about 7 mm. in depth. The scales are rather thick and unornamented except for a number of very small pits anterior and fine lines of growth ventrally. The posterior margins of the scales are roughly serrated.

(iv.) TYPE D. (Text-fig. 10.)

*Material and Locality :—*

Traill Island. Nedre Fiskhoris. Ravin 11.

T1-T5, T7-T12, T14-T19.

Traill Island. Øvre Fiskhoris.

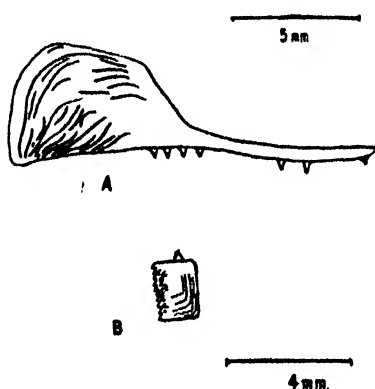
T13.

Collected by Nielsen.

*Description.*

The material consists of scales and occasionally associated maxillaries. The maxillaries (text-fig. 10, A) are of the common Palæoniscid shape, in which the expanded portion is well developed and more or less rectangular. The anterior limb, however, forms an obtuse angle with the sloping anterior margin of the expanded part, which is ornamented with striæ, varying in number in the

Text-fig. 10.



A, maxillary T1B ; B, scale of type D.

different specimens and radiating upwards and forwards from the lower posterior corner.

The scales (text-fig. 10, B) are of small size, usually about 2 mm. in height, and ornamented with fine striæ running parallel with the anterior and bottom margins. The top posterior corner usually has a few very flat elongated tuberculations parallel with the top margin. The posterior margin is denticulated.

(v.) TYPE E. (Text-fig. 11.)

*Material and Locality :—*

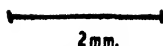
Trail Island. Nedre Fiskhoris. Ravin II.

T20AB, T22, T23, T32.

Collected by Nielsen.



Text-fig. 11.



Scale of type E. T23.

*Description.*

The material consists of a few small isolated scales, the exposed part of which measures about 2 mm. in width and  $2\frac{1}{2}$  mm. in depth, and is ornamented with well-marked ridges, some parallel with the dorsal and ventral margins and others oblique. The posterior margin is coarsely denticulated.

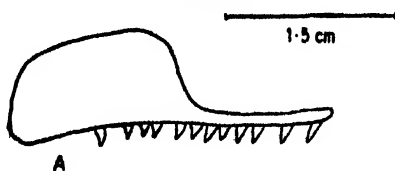
## (vi.) TYPE F. (Text-fig. 12.)

Mesters Vig. Lager 10. Profil 1. Fossilhor. 3.

Pc62B, Pc68AB, Pc70AB, Pc236AB.

Collected by Bierther.

Text-fig. 12.


  
3mm.

A, maxillary; B, scale of type F. Pc68A.

*Description.*

The material consists of the remains of some head-bones, scales and lepidotrichia. The scales are distinguished from those already described in having, on the posterior half of the scale, an ornamentation of fine grooves running together into points and giving the appearance of fine denticles. The anterior part of the scale is smooth. The maxillary has an expanded portion shaped as in the majority of Palæoniscids. In both upper and lower jaws the teeth are relatively large and conical.

(vii.) TYPE G. (Text-fig. 13.)

*Material and Locality* :—

Mesters Vig. Läger 8. Profil 6. 95M.

Pc201AB.

Collected by Bierther.

Text-fig. 13.



2mm.

Scale of type G. Pc201A.

*Description.*

The material consists of a number of scales and one closely tuberculated head-bone. The scales are small; the exposed part of the largest measuring about 1.5 mm. in breadth and 2 mm. in depth. The ornamentation of this area consists of a number of short striæ lying at an obtuse angle to the front, bottom, and back margins. The posterior margin is serrated.

(viii.) TYPE H. (Text-fig. 14.)

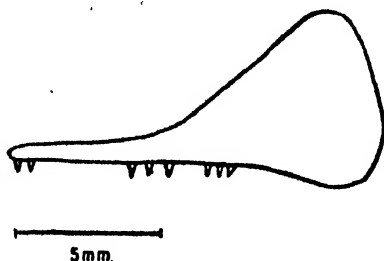
*Material and Locality* :—

Traill Island. Nedre Fiskhoris. Ravin II.

T24AB, T25.

Collected by Nielsen.

Text-fig. 14.



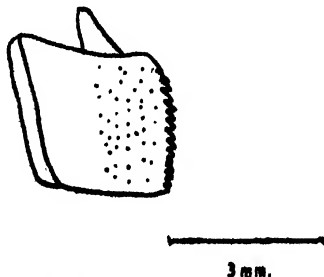
Maxillary of type H. T24B.

*Description.*

The material consists of two maxillaries with strikingly triangular expanded portions, ornamented with a few striæ. The teeth are conical but rather fine.

(ix.) TYPE I. (Text-fig. 15.)

Text-fig. 15.



Scale of type I. Pc.171.

*Material and Locality :—*

Mesters Vig. Läger 9. Profil 2. Fossilhor. 8.

Pc170, Pc171.

Collected by Bierther.

*Description.*

The material consists of a few dermal roof-bones, the cleithra, supracleithra, the rays of the pectoral fin and a few scattered scales. The scales are smooth except for a few minute tubercles on some and are finely denticulated posteriorly. They measure about 2.5 mm. in breadth

and about 3 mm. in length. The lepidotrichia of the fin are entirely unjointed. The bones of the pectoral girdle are ornamented with well-marked striæ running mainly parallel with their long axes, and the roof-bones with rather flat vermiculating ridges.

#### 4. SUMMARY.

Carboniferous Palæoniscids from East Greenland are described for the first time. Among material which probably represents a large and varied fauna, it has only been possible to describe two forms in detail. Both these fishes are new and have been assigned generic rank, being described as *Whiteichthys greenlandica*, gen. et sp. nov., and *Aldingeria biertheri*, gen. et sp. nov. The fauna, as far as can be judged from the remains described, is unlike any Carboniferous fauna so far known elsewhere.

#### 5. BIBLIOGRAPHY.

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#### EXPLANATION OF PLATE XII.

- A. *Whiteichthys greenlandicus*, gen. et sp. nov. Holotype. Pc42A.  
B. *Aldingeria biertheri*, gen. et sp. nov. Holotype. Pc129.

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LXII.—*New or little-known Tipulidæ (Diptera).*—LXV. *Neotropical Species.* By CHARLES P. ALEXANDER, Ph.D., F.R.E.S., Massachusetts State College, Amherst, Massachusetts, U.S.A.

THE crane-flies discussed herewith are all from Peru and virtually all from the Department of Ayacucho, where they were collected by Mr. Felix Woytkowski, to whom my deepest thanks are extended for this co-operation. All of the species described belong to the single genus *Limonia* Meigen, vastly developed in Tropical America, as, indeed, in almost all parts of the world, including the most remote oceanic islands. There seems to be no question but that this genus will vastly exceed all other Tipulid groups in the number of included species. The types of the novelties are preserved in my personal collection of these flies.

*Limonia (Dicranomyia) bigladia*, sp. n.

General coloration dark greyish brown, the præscutum with a still darker median stripe; rostrum and scape of antenna yellow; median region of scutum and the scutellum conspicuously light grey; halteres unusually long and slender; wings with a light brown tinge, stigma a trifle darker;  $Sc_1$  long; abdomen relatively elongate; male hypopygium unusually complicated by outgrowths and setal areas on basistyle and ventral dististyle; each basistyle with a powerful sword-like spine at apex of ventromesal lobe.

*Male*.—Length about 7 mm.; wing 8 mm.

Rostrum obscure yellow, about one-half the length of remainder of head; palpi black. Antennæ with scape light yellow, pedicel and flagellum black; basal flagellar segments oval, the outer ones more elongate; verticils of outer segments shorter than the segments alone; terminal segment slightly longer than the penultimate. Head light grey; anterior vertex relatively wide, nearly three times the diameter of scape.

Pronotum dark brown above, slightly paler on sides. Mesonotal præscutum dark greyish brown, with a still darker brown median stripe, the lateral stripes scarcely indicated; humeral region of præscutum a little more buffy; scutal lobes dark brown; median region of scutum and the scutellum conspicuously light grey; mediotergite dark brown, grey pruinose. Pleura and pleurotergite pale brownish yellow with a sparse pruinosity, the ventral sternopleurite slightly darker. Halteres unusually long and slender, dark brown, the base of the stem brightened. Legs with the coxæ and trochanters obscure testaceous yellow; femora brown, the bases restrictedly obscure yellow; tibiæ and tarsi pale brown, the terminal tarsal segments darker. Wings with a light brown tinge, the oval stigma a very little darker; veins delicate, pale brown. Ventation:  $Sc_1$  ending opposite origin of  $R_s$ ,  $Sc_2$  far from its tip so  $Sc_1$  alone is about equal to  $R_s$ ;  $m-cu$  close to fork of  $M$ ; vein 2nd  $A$  sinuous, the cell relatively narrow.

Abdominal tergites dark brown, the sternites obscure brownish yellow; caudal borders of segments pale, more extensive and conspicuous on outer tergites; segments eight or nine more uniformly darkened; hypopygium yellowish brown. Male hypopygium (fig. 1) with the

tergite, 9t, very large, transversely oval in outline; caudal border on either side of median line with a strong tubercle, the mesal portion and base of which is provided with about fifteen strong but not particularly long spinous setæ; elsewhere on tergal disk a transverse row of more

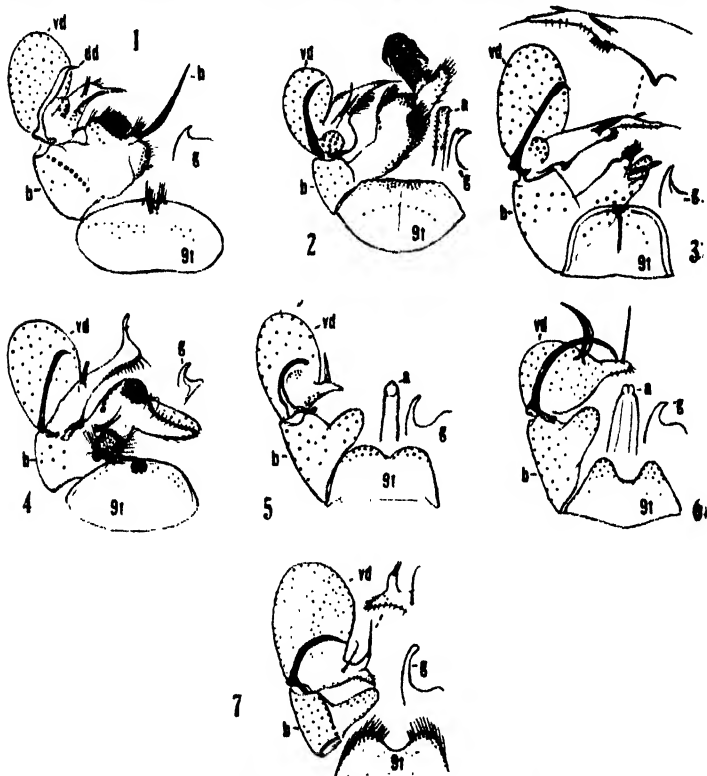


Fig. 1.—*Limonia* (*Dicranomyia*) *bigladiæ*, sp. n.; male hypopygium.  
 Fig. 2.—*Limonia* (*Dicranomyia*) *humerosæ*, sp. n.; male hypopygium.  
 Fig. 3.—*Limonia* (*Dicranomyia*) *muliercula*, sp. n.; male hypopygium.  
 Fig. 4.—*Limonia* (*Dicranomyia*) *imitabilis*, sp. n.; male hypopygium.  
 Fig. 5.—*Limonia* (*Dicranomyia*) *complacita*, sp. n.; male hypopygium.  
 Fig. 6.—*Limonia* (*Dicranomyia*) *diversigladiæ*, sp. n.; male hypopygium.  
 Fig. 7.—*Limonia* (*Geranomyia*) *heteroxipha*, sp. n.; male hypopygium.

(Symbols: a, ædeagus; b, basistyle; dd, dorsal dististyle;  
 g, gonapophysis; t, 9th tergite; vd, ventral dististyle.)

delicate setæ from conspicuous punctures. Basistyle, b, relatively small, down the face of main portion with an oblique row of about ten very long and powerful setæ, those at either end of row shorter and weaker; ventromesal

lobe complex, chiefly bilobed, the lateral lobe densely provided with numerous strong spines or spinous setæ; inner lobe subequal in size, with numerous long delicate pale setæ; between these two lobes extends chiefly caudad a very powerful flattened blade that is evidently comprised of several strong fasciculated setæ, the spine at apex produced into a needle point. Dorsal dististyle, *dd*, relatively weak and of somewhat peculiar conformation, as shown, narrowed on basal third, the tip acute. Ventral dististyle, *vd*, relatively large, its total area approximately equal to that of the basistyle; rostral prolongation strongly developed, separated from the main body of style by a deep notch that is occupied by a rounded lobe or cushion that is provided with a few very long setæ; blade of prolongation compressed, narrowed to a long apical point; rostral spines subequal in length, placed close together on face of blade, not arising from basal tubercles; near base of blade on margin with a conspicuous hair-pencil. Gonapophysis, *g*, with mesal apical lobe short and pale, inconspicuous. *Ædeagus* glabrous.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Yanamonte, La Mar, in fog forests, altitude 3000–4100 metres, October 3, 1941 (*Woytkowski*).

*Limonia (Dicranomyia) bigladia* is one of numerous species of the subgenus having the halteres exceedingly long and slender and with the male hypopygium very complex in structure. From all such species, the present fly differs conspicuously in the presence of the major spine at apex of ventromesal lobe of basistyle, from which character the specific name is derived.

*Limonia (Dicranomyia) humerosa*, sp. n.

General coloration dark brown; antennæ black throughout; halteres elongate, black throughout; legs brown; wings with a brown tinge, the oval stigma slightly darker brown; *Sc*<sub>1</sub> long, subequal to *Rs*; male hypopygium with the tergite large, its caudal border nearly truncate; basistyle with the ventromesal lobe very complicated by outgrowths and hair brushes; dorsal dististyle a relatively weak, gently curved rod; ventral dististyle with the rostral prolongation a flattened compressed blade, the two spines unequal in length, arising from a common tubercles; gonapophyses with mesal-apical lobe unequally bidentate at tip.

*Male*.—Length about 6.5 mm. ; wing 7 mm.

Rostrum obscure yellow ; palpi black. Antennæ black throughout ; flagellar segments short-cylindrical, passing into elongate, the terminal segment nearly twice the length of the penultimate ; longest verticils unilaterally distributed, exceeding the segments in length. Head dark brown ; anterior vertex of moderate width, about one-half wider than the diameter of scape.

Pronotum dark brown, somewhat paler laterally. Mesonotal præscutum dark brown, the humeral and lateral portions of præscutum paling to obscure yellow ; scutellum obscure testaceous brown. Pleura obscure testaceous yellow, vaguely patterned with slightly darker, especially on the anepisternum and ventral sternopleurite. Halteres elongate, black throughout, the outer portion of stem fringed with long conspicuous setæ. Legs with the coxæ and trochanters testaceous yellow ; femora brown, the bases restrictedly brightened ; tibiæ and tarsi brown. Wings with a rather strong brownish tinge, the oval stigma slightly darker brown, well-delimited ; veins brown. Venation :  $Sc_1$  ending opposite origin of  $Rs$ ,  $Sc_2$  far from its tip,  $Sc_1$  alone subequal to the arcuated  $Rs$  ; cell 1st  $M_2$  relatively large, subequal in length to vein  $M_{1+2}$  beyond it ;  $m-cu$  a short distance before fork of  $M$  ; cell 2nd  $A$  relatively narrow, the vein gently sinuous, cell 1st  $A$  narrowed just beyond the level of arculus.

Abdomen dark brown above, sternites obscure yellow, the incisures feebly darkened, the outer segments, with the hypopygium, more uniformly darkened. Male hypopygium (fig. 2) with the tergite, 9t, large, the caudal margin nearly truncate, the cephalic border convexly rounded ; surface of tergite with numerous setæ that are more densely grouped on either side of mid-line near caudal border ; in addition, closer to mid-line of sclerite with a gently curved row of about sixteen very long setæ. Basistyle,  $b$ , relatively small, its ventromesal lobe very large and complicated by outgrowths, as figured ; outermost lobule with a group of six or seven very powerful setæ at outer angle, the inner portion with a very dense comb of short spines ; margin of lobe with coarse setæ that become flattened and spinous on the outer portion of the series ; outermost lobules of appendage with additional coarse setæ, the extreme outer one very densely covered with yellow setæ or spinous bristles, the inner series exceedingly



long and flattened, strongly recurved upon themselves to form a dense mane. Dorsal dististyle a relatively weak rod, more curved to the acute apical spine than in most allied forms. Ventral dististyle, *vd*, with the main body unusually small, its area very much less than that of the basistyle; rostral prolongation conspicuously compressed-flattened, narrowed into a slender apical point, the lower margin of blade with a row of coarse setæ; rostral spines two, slightly unequal in length, arising from summit of a conspicuous tubercle that exceeds in length one-half the shorter spine; at base of rostrum with a globular lobule provided with several setæ. Gonapophyses, *g*, with mesal-apical lobe slender, nearly straight, conspicuously but unequally bidentate at tip; mesal portion of apophysis at base densely setuliferous. Aedeagus, *a*, unusually slender, the distal portion with long conspicuous but very delicate setæ.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Yanamonte, La Mar, in fog forests, altitude 3000–4100 metres, October 7, 1941 (*Woytkowski*).

*Limonia (Dicranomyia) humerosa* is a further species of the subgenus having conspicuous outgrowths and hair-brushes on the basistyle of the male hypopygium. All of these species are best separated by the details of structure of the hypopygium which, while very complex, is capable of some definition and illustration. The present fly is well distinguished by the ventral dististyle, basistyle and the bidentate gonapophyses.

*Limonia (Dicranomyia) muliercula*, sp. n.

General coloration dark brownish grey, the præscutum with a single darker brown median stripe; rostrum black; antennæ with the scape brownish yellow, remainder of organ black; head grey, anterior vertex relatively wide; wings with a weak brownish tinge, stigma a trifle darker; *Sc*<sub>1</sub> subequal in length to *Rs*; abdomen and halteres elongate; male hypopygium with basistyle and rostral prolongation of the ventral dististyle complex in structure; ninth tergite with a close median group of about four very long setæ near caudal margin.

*Male*.—Length about 7 mm.; wing 7 mm.

Rostrum relatively small, blackened, more or less grey pruinose; palpi black. Antennæ with scape brownish yellow, pedicel and flagellum uniformly black; flagellar-

segments oval, the outer segments passing into long-oval ; verticils relatively weak and inconspicuous, shorter than the segments ; terminal segment about one-third longer than the penultimate. Head light grey ; anterior vertex relatively wide, fully three times the diameter of scape.

Pronotum dark brown above, sparsely pruinose on sides. Mesonotum relatively high and gibbous, dark brownish grey, the præscutum with a single, darker brown, median stripe ; scutal lobes more or less infuscated. Pleura brownish grey, the meral region paler. Halteres of unusual length and slenderness ; stem pale brown, knob darker. Legs with the coxæ obscure yellow, the fore pair darker basally ; trochanters obscure yellow ; femora obscure brownish yellow at bases, passing into brown ; remainder of legs dark brown, the terminal tarsal segments blackened. Wings with a weak brownish tinge, the oval stigma a trifle darker ; veins brown, delicate. Venation : *Sc* short, *Sc*<sub>1</sub> ending a short distance before origin of *Rs*, *Sc*<sub>2</sub> some distance from its tip, *Sc*<sub>1</sub> alone subequal in length to the more arcuated *Rs* ; cell 1st *M*<sub>2</sub> about equal in length to vein *M*<sub>3</sub> beyond it ; *m-cu* just beyond fork of *M*.

Abdomen elongate ; tergites dark brown, basal sternites obscure brownish yellow, the more basal segments somewhat clearer yellow, the outermost segments, with the hypopygium, uniformly darkened. Male hypopygium (fig. 3) with the tergite, 9*t*, large, the caudal border convexly rounded, the margins more or less blackened and sclerotized ; median portion near caudal margin with about four very long setæ that are about two-thirds as long as the tergite itself ; elsewhere on surface with a few scattered shorter setæ. Basistyle, *b*, with outer face having relatively few setæ ; ventromesal lobe complex, about as figured, including a heavily blackened apical lobule terminating in microscopic cultrate blades and longer curved flattened bristles, at base of lobule with an obtuse shoulder ; a second lobule is paler ; in the notch between these two with a pencil of long bristles and a smaller fleshy lobe.

Dorsal dististyle a straight rod, the tip abruptly narrowed and decurved. Ventral dististyle, *vd*, large and fleshy, its area exceeding that of basistyle ; rostral prolongation elongate, of irregular conformation, as shown ; spines two, placed close together at near mid-length of the prolongation, the more basal spine slightly shorter ; ventral margin of prolongation near base with a conspicuous black-

ened lobe or flange; more distally the margin opposite the rostral spines is dilated into a low tubercle set with numerous setae. Gonapophyses, *g*, with mesal-apical lobe short, acute, the mesal margin microscopically roughened. Aedeagus, *a*, pale, with a row of pale spines along its face.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Yanamonte, La Mar, in fog forests, altitude 3000–4100 metres, October 3, 1941 (*Woytkowski*).

*Limonia* (*Dicranomyia*) *muliercula* is allied to several other regional species having the male hypopygium unusually complicated by outgrowths of the basistyle and ventral dististyle. It is most similar to species such as *L. (D.) apposita* Alexander, yet amply distinct.

*Limonia* (*Dicranomyia*) *imitabilis*, sp. n.

General coloration pale yellow, the pronotum and cephalic portion of præscutum with a narrow median brown line; rostrum yellow; antennæ with scape yellow, succeeding segments black; halteres elongate, darkened throughout; legs pale brown, the tips of femora narrowly pale; wings tinted with ochreous, the stigma faintly darker; *Sc*<sub>1</sub> long; male hypopygium with tergite large, the posterior border with a median group of more than a dozen elongate setae; basistyle short, its ventromesal lobe greatly complicated by outgrowths and setal tufts; rostral prolongation of ventral dististyle elongate, at outer end produced at a right-angle into a slender arm.

*Male*.—Length about 6.5 mm.; wing 7.5 mm.

Rostrum yellow, relatively short; palpi with basal segments yellow, the outer ones brown. Antennæ with scape yellow, pedicel and flagellum black; basal flagellar segments long-oval, the succeeding segments passing through short-cylindrical to elongate; terminal segment about one-half longer than the penultimate; verticels shorter than the outer segments. Anterior vertex pale, silvery pruinose, remainder of head yellow; anterior vertex moderately wide, exceeding twice the diameter of scape.

Pronotum obscure yellow, narrowly darkened medially above, this colour continued caudad for more than one-half the length of the mesonotal præscutum; remainder of mesonotum uniform yellow. Pleura uniformly still paler yellow. Halteres elongate, darkened throughout. Legs with coxæ and trochanters yellow; femora pale

brown, their tips narrowly yellow; tibiæ and tarsi pale brown. Wings tinted with ochreous, the oval stigma only faintly darker; veins brown. Venation: *Sc* relatively short, *Sc*<sub>1</sub> ending about one-third the length of *Rs* before the origin of the latter; *Sc*<sub>2</sub> far from tip of *Sc*<sub>1</sub>, the latter subequal in length to the strongly arcuated *Rs*; cell 1st *M*<sub>2</sub> large, longer than vein *M*<sub>1+2</sub> beyond it; *m-cu* at fork of *M*; vein 2nd *A* gently sinuous.

Basal abdominal tergites weakly infuscated, the outer segments and hypopygium more strongly so; sternites yellow. Male hypopygium (fig. 4) with the ninth tergite, 9t, large and ample, both the caudal and cephalic borders convexly rounded, especially the latter; near posterior border a compact median group of more than a dozen elongate setæ that are fully one-half as long as the total length of tergite. Basistyle, *b*, very short, with sparse coarse setæ; ventromesal lobe much complicated by outgrowths and armatures of spines and hair-tufts; the major lobe, nearest the dististyle, bears a row of six or seven very strong, powerful, spinous setæ; apex of lobe beyond this point with a group of more abundant shorter setæ; near base of primary lobe with two very long and strongly modified setæ; attached distally to the primary lobe a further ear-like lobule or appendage, likewise provided with abundant modified setæ; more basally, the ventromesal lobe bears an oval cushion that is very densely set with flattened pale setæ in addition to fewer powerful spinous bristles, together with a small pencil of eight to ten very long setæ. Dorsal dististyle a relatively weak, nearly straight rod, its tip acute and decurved at a right angle. Ventral dististyle, *vd*, a large fleshy lobe, its area somewhat greater than the total area of the basistyle; rostral prolongation a relatively narrow sclerotized rod, at apex further produced at a right-angle into a slender arm; lower margin of outer portion of prolongation with a linear series of strong setæ; rostral spines two, placed at about the basal third of the prolongation, arising from summit of a short common tubercle, both spines subequal in length, approximately three times that of the tubercle. Gonapophyses, *g*, very small, the mesal-apical lobe nearly straight but weak.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Yanamonte, La Mar, in fog forests, altitude 3000-4100 metres, October 2, 1941 (Woytkowski).

*Limonia (Dicranomyia) imitabilis* is quite different from the other allied regional species having greatly complicated outgrowths on the male hypopygium. Among such forms it is perhaps most similar to *L. (D.) muliercula*, yet entirely distinct.

*Limonia (Dicranomyia) complacita*, sp. n.

General coloration blackish, grey pruinose; rostral prolongation black; antennæ black throughout, flagellar segments oval; halteres with stem white, knob blackened; legs with femora brownish yellow, with a nearly terminal dark brown ring; wings whitish subhyaline, heavily patterned with brown; *Rs* square and spurred at origin; *m-cu* before fork of *M*; male hypopygium with caudal margin of tergite notched; dorsal dististyle obtuse at tip; rostral prolongation of ventral dististyle short, the two spines straight, slightly unequal in length.

*Male*.—Length about 6.5 mm.; wing 7.8 mm.

Rostrum slightly shorter than the remainder of head, polished black; palpi black. Antennæ black throughout; flagellar segments short-oval; verticils subequal in length to the segments. Head dark grey, the centre of vertex restrictedly darkened; anterior vertex relatively wide, about three times the diameter of scape.

Pronotum blackish, dark grey pruinose. Mesonotal præscutum dark grey with three black stripes, the median one broad and conspicuous, not reaching the suture behind; lateral stripes very narrow and inconspicuous; posterior sclerites of notum blackened, very sparsely pruinose, the centres of scutal lobes conspicuously blackened, the median area and base of scutellum grey pruinose. Pleura dark grey, restrictedly patterned with darker on ventral anepisternum and ventral sternopleurite. Halteres with stem conspicuously white, knob blackened. Legs with coxæ blackened, grey pruinose; trochanters brown; femora obscure brownish yellow, with a nearly terminal dark brown ring, the very narrow apex obscure yellow; tibiæ and tarsi brown, the terminal segments blackened; claws with one conspicuous spine and reduced more basal ones. Wings whitish subhyaline, handsomely and conspicuously patterned with brown, as follows:—prearcular field and axillary margin; stigma; cord and outer end of cell 1st  $M_2$ , including a major oval area at fork of *Rs*; two oval spots in centre of cell *R* before origin of *Rs*, the more

basal one larger ; distinct paler brown washes in outer radial and medial fields, chiefly adjoining the veins ; further brown washes in cells *M*, *Cu* and outer ends of both anal cells ; no very distinct cloud at fork of *Sc* ; veins brown, scarcely darker in the clouded areas. Venation : *Sc* short, *Sc*<sub>1</sub> ending a short distance before origin of *Rs*, *Sc*<sub>2</sub> not far from its tip ; *Rs* relatively short, square and spurred at origin ; cell 1st *M*<sub>2</sub> relatively long, subequal to vein *M*<sub>3</sub> beyond it ; *m-cu* varying from approximately one-half to nearly its own length before the fork of *M* ; vein 2nd *A* convexly arched, not sinuous.

Abdomen brownish black, sparsely pruinose ; hypopygium scarcely brightened. Male hypopygium (fig. 5) with the ninth tergite, 9*t*, transverse, the caudal margin rather broadly emarginate, the lateral lobes broadly obtuse, with numerous setæ. Basistyle, *b*, with the ventromesal lobe simple, dark-coloured, provided with abundant setæ, some of which are subequal in length to the lobe itself. Dorsal dististyle a relatively short curved rod, its tip obtuse. Ventral dististyle, *vd*, large and fleshy, in area much exceeding the basistyle ; rostral prolongation relatively short, with two straight spines shortly beyond mid-length of outer surface ; spines placed close together, the inner one a trifle longer than the outer ; outer portion of rostrum relatively short, less than the length of the outer spine. Gonapophyses, *g*, with mesal-apical lobe long and narrow, almost straight. Ædeagus, *a*, narrow.

*Hab.* Peru (Junin).

*Holotype*, ♂, Tulumayo Valley, Tarma, altitude 4000–8000 ft., September 10, 1940 (*Woytkowski*).

*Limonia* (*Dicranomyia*) *complacita* is very different from all other described regional members of the subgenus. Superficially ; it somewhat resembles species such as *L.* (*D.*) *jorgenseni* (Alexander), but is entirely distinct.

*Limonia* (*Dicranomyia*) *diversigladia*, sp. n.

Allied to *latispina* ; general coloration brown, the mesonotum without distinct pattern ; femora obscure yellow, the tibiæ and tarsi passing into black ; wings with a weak brown tinge ; *Sc*<sub>1</sub> ending opposite origin of *Rs*, *Sc*<sub>2</sub> some distance from its tip ; male hypopygium with the rostral spines very dissimilar in shape, the outer one a long slender straight spine placed on the rostrum, the inner

spine a curved flattened blade placed on the face of the style itself.

*Male*.—Length about 7 mm. ; wing 8 mm.

Rostrum slightly pendant, obscure yellow ; palpi black. Antennæ black throughout ; basal flagellar segments oval, soon passing into elongate-oval ; terminal segment a trifle exceeding the penultimate ; verticils subequal in length to the segments. Head brown, sparsely patterned with still darker brown ; anterior vertex wide, approximately twice the diameter of the scape.

Pronotum relatively long, dark brown above, paler brown on sides. Mesonotum almost uniform medium brown, without distinct pattern ; præscutal setæ sparse but long and conspicuous. Pleura brown, the ventral sclerites a trifle paler. Halteres relatively long, blackened, the base of stem pale. Legs with coxæ obscure brownish testaceous ; trochanters yellow ; femora obscure yellow, their tips weakly infuscated ; tibiæ and tarsi passing through brownish black to black ; claws with one major tooth and more basal microscopic denticles. Wings with a weak brown tinge, the oval stigma a trifle darker ; veins brown, a little more yellowish brown in the prearcular and costal fields. Venation :  $Sc_1$  ending opposite origin of  $Rs$ ,  $Sc_2$  some distance from its tip,  $Sc_1$  alone exceeding one-half the length of  $m-cu$ , the latter at fork of  $M$ .

Abdominal tergites dark brown, somewhat paler laterally ; sternites and hypopygium obscure yellow. Male hypopygium (fig. 6) with the tergite, 9t, deeply emarginate, the lobes relatively narrow, obtuse, with conspicuous setæ. Ventromesal lobe of basistyle simple. Dorsal dististyle a slender, strongly-curved hook, the tip acute. Ventral dististyle,  $vd$ , relatively small, pale, in area somewhat less than the basistyle ; two rostral spines of very different appearance, the outermost a long slender straight spine placed at near three-fourths the length of the moderately long rostral prolongation ; second spine on the face of the style itself, appearing as a shorter flattened blade, gently curved to the acute tip. Gonapophyses,  $g$ , with mesal-apical lobe relatively short, the tip narrowly blackened.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Yanamonte, La Mar, in fog forests, altitude 3000–4100 metres, October 2, 1941 (*Woytkowski*).

*Limonia* (*Dicranomyia*) *diversigladia* is most similar to *L. (D.) latispina* Alexander, likewise of Peru, differing

very conspicuously in the structure of the male hypopygium, notably the formation and position of the rostral spines.

*Limonia (Rhipidia) aphrodite*, sp. n.

Size large (wing, male, 11 mm.) ; antennæ (male) with 10 long-bipectinate segments, the first flagellar segment simply pectinate ; pleura reddish brown with a broad black dorsolongitudinal stripe ; femora dusky, the tips narrowly blackened, preceded by a vague yellow ring ; wings cream-yellow, heavily patterned with brown ; numerous macrotrichia in outer cells of wing ; abdomen conspicuously hairy, the segments dimidiate, their bases yellow, the apices black ; male hypopygium with two relatively short rostral spines.

*Male*.—Length about 10 mm. ; wing 11 mm. ; antenna about 3·8 mm.

Rostrum black, relatively long, with the mouth-parts slightly exceeding the remainder of head ; palpi black. Antennæ black, the apical pedicels of the branched segments yellow ; ten long-bipectinate segments, the longest branches (at mid-length of organ) exceeding one-fourth the length of the entire antennæ ; first flagellar segment with a simple stout protuberance, the short apical pedicel black ; terminal segment elongate, nearly twice the length of the penultimate segment ; basal enlargements of segments with unusually long verticils ; branches covered with a dense white pubescence. Head grey, with coarse black setæ ; eyes (male) very large, broadly holoptic.

Pronotum dark brown. Mesonotum reddish brown, the humeral and central portions of præscutum with a broad central black stripe, more diffuse and slightly paler on cephalic half, the region of the usual lateral stripes remaining of the reddish ground-colour ; posterior sclerites of notum brownish black, the suture between the mediotergite and the pleurotergite, with the posterior portion of the former, more reddish. Pleura reddish brown, with a broad black dorsal stripe extending from the cervical region to the pleura. Halteres relatively short, blackened, the base of stem narrowly yellow. Legs with the coxæ blackened, the fore pair a little paler ; trochanters obscure yellow ; femora infuscated basally, the tips narrowly but conspicuously blackened, preceded by a wider but vague yellowish ring, the pattern approximately similar on all



legs ; tibiae and tarsi yellowish brown to pale brown, the tips of tibiae very narrowly darkened, the terminal tarsal segments passing into black ; claws with a single long acute spine and shorter, less conspicuous denticles. Wings with the restricted ground cream-yellow, the remainder of surface heavily patterned with brown ; five major costal areas of a still darker colour, the third at origin of *Rs*, the fifth at stigma, all of these areas confluent with the very extensive darkened areas behind ; the brightened ground appears in the small costal interspaces, as several areas in the outer radial and medial fields, as a longitudinal stripe in cell 1st *A*, and as an axillary brightening involving both anal cells ; veins dark brown, *Sc* and *R* in the costal interspaces bright yellow. Outer cells of wing with abundant and conspicuous macrotrichia, involving all cells beyond cord, as well as the outer ends of cells *Cu* and 1st *A*. Venation : *Sc*<sub>1</sub> ending about opposite four-fifths the length of *Rs*, *Sc*<sub>2</sub> near its tip ; cell 1st *M*<sub>2</sub> relatively small, irregularly pentagonal in outline, *m* being arcuated, the other elements closing the cell straight ; *m-cu* about one-fourth its own length before fork of *M*.

Abdomen relatively long, conspicuously hairy ; segments dimidiate, their bases yellow, the apices black, on the more proximal segments the yellow exceeding the dark colour ; hypopygium dark brown. Male hypopygium with the ninth tergite transverse, the caudal margin evenly and convexly rounded. Basistyle relatively small, the ventromesal lobe simple, without modified lobes or setae. Dorsal dististyle a strongly-curved blackened hook, the acute tip a decurved spine. Ventral dististyle relatively small, its area less than that of basistyle ; rostral prolongation relatively short, with two short spines placed close together at mid-length ; spines a little shorter than the prolongation beyond their insertion. Gonapophysis with mesal-apical lobe blackened, relatively narrow, the extreme tip suddenly narrowed.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Yanamonte, La Mar, in fog forests, altitude 3000–4100 metres, September 7, 1941 (*Woytkowski*).

*Limonia* (*Rhipidia*) *aphrodite* is strikingly different from all previously-described members of the subgenus in the hairy wings. Despite this difference, the fly is closest to species such as *L. (R.) cytherea*, sp. n., and *L. (R.) stonei* Alexander.

*Limonia (Rhipidia) cytherea*, sp. n.

Size large (wing, female, over 11 mm.); mesonotum chiefly brown, the præscutum with the lateral margins broadly yellow; thoracic pleura dark brown with a broad, very conspicuous, black, longitudinal stripe; femora yellow, slightly more blackened on basal half; wings with a strong brownish yellow tinge, restrictedly patterned with large brown clouds and seams; *Rs* elongate; stigmal trichia present; abdominal tergites obscure yellow, narrowly darkened laterally; ovipositor with cerci blackened, very slender.

*Female*.—Length about 10 mm.; wing 11.2 mm.; antenna about 2.2 mm.

Rostrum black, relatively elongate, subequal to the remainder of head; palpi black. Antennæ with basal swelling and pectinations black, the apical pedicels abruptly yellow; flagellar segments simply produced, the longest pectination about two-thirds the total length of the segment. Head grey; anterior vertex reduced to a linear blackened strip that is less than the diameter of a single row of ommatidia.

Pronotum brownish yellow above, blackened laterally. Mesonotum with the disk chiefly covered by three brown stripes that are almost confluent, restricting the interspaces to feebly differentiated narrow lines; lateral and humeral portions of præscutum broadly yellow; posterior sclerites of notum brown, the posterior half of mediotergite more testaceous. Pleura dark brown, the dorsal portion, with the dorsopleural membrane, covered by a broad, very conspicuous, longitudinal, black stripe extending from the cervical region to the base of the abdomen, chiefly passing beneath the wing-root. Halteres dusky, base of stem restrictedly pale; knob elongate, merging gradually with the stem, the latter fringed unilaterally with long setæ. Legs with the coxæ infuscated, the fore pair slightly paler at tips; trochanters obscure yellow; femora yellow, slightly more blackened on basal half, the extreme proximal ends pale; tibiæ and basitarsi brown, the outer tarsal segments black; claws toothed. Wings with a strong brownish-yellow tinge, clearer yellow in costal portions; a heavy but restricted brown pattern, as follows:—a weak darkening in humeral region; a major area at one-third the length of cell *C*, extending caudad almost to vein *M*; a smaller

darkening at origin of *Rs*, including cells *C*, *Sc* and *R*, but interrupted by the yellow vein *R*; a major dark cloud at and above *m-cu*, involving the adjoining portions of vein *M* and including clouds in outer radial and medial fields that are more extensive than the pale ground; stigma pale brown, narrowly more darkened along veins at outer end; strong brown washes in cubital and anal fields; veins yellow, more infuscated in the clouded portions. Stigma with from 14 to 18 macrotrichia. Venation: *Sc* long, *Sc*<sub>1</sub> ending shortly before fork of *Rs*, *Sc*<sub>2</sub> near its tip; *Rs* long, weakly angulated at origin; cell 1st *M*<sub>2</sub> relatively small, irregularly pentagonal, *m* longer than the basal section of *M*<sub>3</sub> and gently arcuated; *m-cu* more than one-half its own length before fork of *M*; vein 2nd *A* strongly sinuous.

Abdomen obscure yellow, the basal segments narrowly darkened laterally; segments rather conspicuously hairy. Ovipositor with the cerci blackened, very slender, strongly upcurved.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Yanamonte, La Mar, in fog forests, altitude 3000–4100 metres, September 2, 1941 (*Woytkowski*).

This unusually beautiful species has no close ally so far described. It is perhaps closest to *Limonia* (*Rhipidia*) *stonei* Alexander, of Colombia, which is of approximately the same size, but is entirely different in coloration.

*Limonia* (*Rhipidia*) *melanaria*, sp. n.

General coloration of mesonotal præscutum reddish brown with three darker brown stripes; pleura with a conspicuous black longitudinal stripe; antennæ black throughout, in male with seven bipectinate segments, in female with segments simply produced; legs black; wings uniformly and very strongly blackened, variegated only by the even darker stigma; male hypopygium with the ventromesal lobe of basistyle stout but simple; rostral prolongation of ventral dististyle slender, with two approximated, very elongate spines.

*Male*.—Length about 5 mm.; wing 5.4 mm.; antenna about 2 mm.

*Female*.—Length about 8 mm.; wing 8.5 mm.; antenna about 1.5 mm.

Rostrum and palpi black. Antennæ black throughout in both sexes; in male, flagellum with seven bipectinate segments; first flagellar segment simply produced; segments two to eight, inclusive, with moderately long branches, the longest about twice the segment; flagellar segment nine with a single branch that exceeds the segment in length; segments ten and eleven each with a slight protuberance only; terminal segment elongate, pointed at apex; in female, flagellar segments with conspicuous basal swellings that are bluntly produced, the enlargements exceeding twice the length of the darkened apical pedicel; terminal segment nearly twice the penultimate, narrowed outwardly. Head behind brownish grey, the anterior vertex brown, darker medially, behind; anterior vertex of female a little less than the diameter of scape, in male even narrower to virtually eliminated by the approximation of the eyes.

Pronotum brownish black. Mesonotal præscutum reddish brown, with three darker brown stripes, in addition to narrowly darkened lateral borders behind the pseudosutural foveæ; præscutal setæ long but sparse; scutal lobes dark brown, the median area paler; scutellum and cephalic half of mediotergite blackened, the posterior half of latter more reddened. Pleura reddish brown with a conspicuous black longitudinal stripe crossing the dorsal sclerites; sides of sternopleurite more narrowly and less conspicuously darkened. Halteres blackened. Legs with coxæ brownish yellow, the fore pair darker; trochanters yellow; remainder of legs uniformly black, only the femoral bases restrictedly brightened. Wings uniformly and very strongly blackened, variegated only by the oval, still darker stigma and the slightly more brightened prearcular field; no brightened areas nor any darkened seams or clouds at cord or elsewhere on surface; veins brownish black. Trichia of veins long and conspicuous; stigmal trichia sparse but present. Venation: *Sc* moderately long, *Sc*<sub>1</sub> ending opposite mid-length of *Rs*, *Sc*<sub>2</sub> not far from its tip; *Rs* relatively long; cell 1st *M*<sub>2</sub> small, irregularly pentagonal, *m* longer and more arcuated than the other elements; *m-cu* at or just beyond fork of *M*.

Abdominal tergites brownish black, weakly dimidiate, the basal portions obscure yellow, posterior borders blackened, in amount a little less than the bases; abdomen

with conspicuous setæ. Ovipositor with cerci long and slender, strongly upcurved. Male hypopygium with the tergite transverse, the lobes low and obtuse. Basistyle with the ventromesal lobe broad-based, simple, with elongate setæ. Dorsal dististyle a very short, gently-curved blackened rod, the tip acute. Ventral dististyle small, dusky, in area subequal to or smaller than the basistyle; rostral prolongation slender, with two very long spines arising close together at near mid-length of prolongation, the spines subequal, about as long as the prolongation itself, directed strongly backward. Gonapophyses with mesal-apical lobe blackened, irregular in conformation.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Ayna, La Mar, altitude 2400 metres, April 23, 1941 (Woytkowski). *Allotype*, ♀, Yanamonte, La Mar, in fog forests, altitude 3000-4100 metres, September 6, 1941 (Woytkowski).

The most similar regional species are *Limonia* (*Rhipidia*) *sprucei* Alexander and *L. (R.) tridigitata* Alexander, both of Ecuador, which are well-distinguished by differences in the antennæ and in the structure of the male hypopygium. The holotype male of the present fly is very much smaller than the female, but the association seems to be correct.

*Limonia* (*Rhipidia*) *superarmata*, sp. n.

Allied to *perarmata*; general coloration of præscutum reddish brown with a darker brown median stripe; antennæ (male) elongate, approximately one-half the entire body, with ten long-bipectinate flagellar segments, the longest branches exceeding three times the segments that bear them; all tarsi black; wings strongly darkened, with a restricted still darker pattern; male hypopygium complex in structure, including a massive blackened phallosomic structure; rostral prolongation of ventral dististyle a long compressed yellow blade, the two spines placed close together far out on the blade.

*Male*.—Length about 7 mm.; wing 7 mm.; antenna about 3.4 mm.

Rostrum and palpi black. Antennæ with ten long-bipectinate flagellar segments; scape, basal enlargements, all flagellar branches and the entire terminal segment black, the long apical pedicels of the remaining flagellar

segments yellow ; pedicel brownish yellow ; branch of first flagellar segment shorter than the pedicel of the segment ; second segment with long branches that are unequal in length, one fully one-half longer than the other, the longest exceeding twice the length of segment ; longest branches (at mid-length of organ) exceeding three times the segments, the two branches more nearly equal to one another in length ; branches of eleventh flagellar segment subequal, nearly three times the length of segment ; terminal segment about one-half longer than the penultimate ; all flagellar branches clothed with coarse erect pale setulæ. Head dark grey ; eyes contiguous.

Pronotum dark brown. Mesonotal præscutum reddish brown, more pruinose laterally, with a darker brown median stripe that does not reach the suture behind ; lateral stripes obsolete or virtually so ; posterior sclerites of notum strongly infuscated, more or less pruinose, especially the mediotergite. Pleura obscure yellow, with two narrow, brownish-black longitudinal stripes, the ventral sternopleurite yellow ; dorsal pleurotergite chiefly pale. Halteres relatively short, stem obscure yellow, knob infuscated. Legs with the coxæ yellow, narrowly darkened across their bases by the ventral pleural stripe ; trochanters yellow ; femora brownish black, their basal portions more obscure yellow ; remainder of legs passing through brown to black ; all tarsi blackened. Wings with the ground-colour strongly darkened, restrictedly patterned with slightly darker brown, including clouds at origin of *Rs*, fork of *Sc*, stigma, anterior cord and outer radial field ; prearcular field more whitened ; veins dark brown. Macrotrichia of veins abundant and conspicuous. Venation : *Sc*<sub>1</sub> ending about opposite three-fifths the length of *Rs*, *Sc*<sub>2</sub> at its tip ; cell 1st *M*<sub>2</sub> relatively long, subequal to vein *M*<sub>3</sub> beyond it ; *m-cu* close to fork of *M*.

Abdominal tergites almost uniformly dark brown, the sternites weakly bicoloured, obscure yellow, with the caudal borders of the segments narrowly infuscated ; hypopygium chiefly darkened. Male hypopygium with the tergite transverse, its caudal margin truncate or very feebly emarginate across the central portion. Basistyle with ventromesal lobe unusually slender, fringed with long coarse setæ along lower margin of distal half. Dorsal dististyle a gently curved dark rod, its tip an acute long

straight spine. Ventral dististyle of moderate size, blackened, the rostral prolongation a long curved yellow blade; rostral spines two, placed close together or on a common tubercle far out on the blade, the apex beyond them shorter than either spine; lower margin of blade at near one-third the length with a group of about five strong setæ. Gonapophyses with mesal-apical lobes blackened, slender, the apex of each a little sinuous. *Ædeagus* much shorter and broader than in *perarmata*, with lateral wings or flanges. Behind the *ædeagus* a massive blackened phallosomic structure with transverse corrugations, apparently rather similar to a comparable structure in *perarmata* but with the details not sufficiently clear in the unique type-slide.

*Hab.* Peru (Junin).

*Holotype*, ♂, Tulumayo Valley, Tarma, altitude 4000–8000 ft., October 10, 1940 (*Woytkowski*).

The present fly is closest to *Limonia* (*Rhipidia*) *perarmata* (Alexander) from Amazonian Peru, differing especially in the details of structure of the male hypopygium, notably the rostral prolongation and the position of its spines, the ventromesal lobe of the basistyle, the mesal-apical lobe of the gonapophysis, and the *ædeagus*.

*Limonia* (*Rhipidia*) *uxor*, sp. n.

General coloration grey, the cephalic half of præscutum with an extensive black area, the posterior half abruptly reddish brown, the posterior and lateral portions heavily pruinose; antennal flagellum (female) long-subpectinate, the subterminal two segments yellow, the remainder black with yellow apical pedicels; fore femora tipped with black, the remaining femora with scarcely indicated brown subterminal rings; wings cream-yellow, restrictedly patterned with brownish black and pale grey, the pale stigma ringed with darker; *m-cu* some distance before fork of *M*; abdominal tergites very weakly bicolored, the lateral portions of the more basal segments narrowly velvety black; ovipositor with cerci unequally bidentate at tips.

*Female*.—Length about 6.5–7 mm.; wing 6.4–6.7 mm.

Rostrum black, subequal in length to remainder of head; palpi black. Antennæ black, the short pedicels of the flagellar segments yellow; penultimate and antepenultimate segments uniformly yellow; flagellar segments

(female) each produced into a stout simple lobe, the longest a little exceeding the apical pedicel of the segment in length. Head grey, the anterior vertex opposite the posterior border of eyes with a trifid blackened area; anterior vertex narrow, about one-third the diameter of scape.

Pronotum brownish black, somewhat paler sublaterally. Mesonotal præscutum with the cephalic half conspicuously blackened, the posterior half abruptly reddish brown, heavily grey pruinose near suture and on sides; lateral borders and humeral region of præscutum extensively grey, with a small marginal black spot behind the pseudo-sutural foveæ; central portion of scutum grey pruinose, the lobes similar but with extensive brownish-black areas; scutellum pale, heavily pruinose; mediotergite with central portion brownish black, the cephalic and lateral portions conspicuously pruinose. Pleura grey pruinose, the mesepisternum with blackened stripes on anepisternum and sternopleurite, the mesepimeron and ventral pleurotergite much more extensively blackened. Halteres short, stem pale, knob weakly infuscated. Legs with coxæ pale yellow, more or less darkened basally, especially the middle pair; trochanters yellow; femora yellow, the tips of fore pair broadly and conspicuously black; middle and hind pairs with narrow, scarcely indicated brown subterminal rings; tibiæ and tarsi yellowish white, only tarsal segments four and five, with the distal end of three, abruptly blackened. Wings with the ground-colour cream-yellow, restrictedly but conspicuously patterned with brownish black and pale grey; the darkest colour is distributed as follows:—a series of four subcostal markings, the third at origin of *R*<sub>2</sub>, the last at fork of vein; along cord and outer end of cell 1st *M*<sub>2</sub>; a conspicuous ring around the otherwise pale oval stigma, more extensive and heavier on distal and posterior portions; narrow marginal seams at ends of longitudinal veins, more extensive on vein 2nd *A*, especially as a submarginal cloud back from the tip; the grey washes occur as central streaks in the outer radial and medial cells and more sparsely in the basal cells, in cell *R* appearing as pale washes behind the subcostal darkenings; a more or less distinct dark cloud in cell *M* adjoining vein *Cu* at about mid-length; veins yellow, darkened in the patterned areas. Venation: *Sc*<sub>1</sub> ending about opposite



two-thirds to three-fourths the length of *Rs*, *Sc*<sub>2</sub> at its tip ; *m-cu* varying from less than one-half to approximately its entire length before the fork of *M*.

Abdominal tergites with the basal segments more or less greenish or yellow, the lateral borders narrowly velvety black ; succeeding segments almost uniformly brown, the basal rings of the segments a very little paler than the distal portions ; sternites darkened, the basal segments slightly paler ; genitalia and preceding segment yellow. Ovipositor with cerci shorter than the hypovalvæ, their tips unequally bidentate.

*Hab.* Peru (Ayacucho).

*Holotype*. ♀, Ayna, La Mar, altitude 2400 metres, May 26, 1941 (*Woytkowski*). *Paratopotype*, ♀, May 31, 1941.

In the pattern of the wings, *Limonia* (*Rhipidia*) *uxor* is generally similar to *L. (R.) domestica* (Osten Sacken) and related forms, differing markedly in the coloration of the body and legs. The bidentate tips of the cerci introduce a character not previously known to me in this subgenus though well known in other subgeneric groups of *Limonia*.

*Limonia* (*Rhipidia*) *thysbe*, sp. n.

General coloration of mesonotal præscutum grey with a conspicuous black median stripe ; antennæ (male) short-unipectinate ; all flagellar branches darkened, the short apical pedicels abruptly yellow ; halteres yellow ; tips of fore femora conspicuously blackened, middle and hind femora yellow with a very weak, pale brown, subterminal ring ; wings cream-yellow, very restrictedly patterned with brown, the stigma pale, ringed with pale brown ; abdominal segments bicolored ; rostral spines of male hypopygium short.

*Male*.—Length about 7 mm. ; wing 9 mm. ; antenna about 1.7 mm.

Rostrum black throughout, about equal in length to remainder of head ; palpi black. Antennæ (male) with eight or nine short-unipectinate flagellar segments ; scape pedicel and all flagellar branches, with the adjoining bases, blackened, the short glabrous apical pedicels abruptly yellow ; longest branches (at near mid-length of flagellum) subequal in length to the segments ; branch of first segment slightly shorter and stouter than the succeeding one or two ; branches of penultimate and antepenultimate

flagellar segments very reduced to scarcely distinguishable; terminal segment about one-half longer than the penultimate, simple and uniformly darkened. Head light buffy grey, the posterior portion of anterior vertex opposite hinder border of eyes darkened; anterior vertex narrowed, approximately one-half the diameter of scape.

Pronotum brownish black, restrictedly patterned with paler sublaterally. Mesonotal præscutum grey, the humeral region restrictedly brightened; a conspicuous black median stripe that is gently constricted at near mid-length and encloses a pruinose spot just before suture; scutum pale medially, the lobes extensively darkened; scutellum testaceous yellow; postnotum infuscated, the lateral portions of mediotergite and most of the dorsal pleurotergite yellow. Pleura brownish grey, the dorsal portion deepening to brownish black, forming a relatively narrow longitudinal stripe that passes beneath the root of halteres to the abdomen. Halteres uniformly pale yellow. Legs with the coxæ testaceous, weakly darkened basally; trochanters yellow; fore femora obscure yellow, the tips broadly blackened, the basal half of segment strongly darkened; middle and hind femora obscure brownish yellow with a narrow to scarcely indicated pale brown ring just before the narrow tip; tibiæ and proximal two tarsal segments of all legs yellow, with very narrow brownish-black tips; remainder of tarsi black; claws with a single major spine. Wings cream-yellow, very restrictedly patterned with brown in the usual *domestica* pattern; the small dark spots occur at *h*, arculus, beyond mid-length of cell *Sc*, origin of *Rs*, *Sc*<sub>2</sub>, along cord, outer end of cell 1st *M*<sub>2</sub>, and as a paler brown oval around the otherwise pale stigma; very restricted marginal darkenings at ends of longitudinal veins, most conspicuous at 2nd *A*; veins yellow, darkened in the patterned areas. Costal fringe relatively short and dense. Venation: *Sc*<sub>1</sub> ending about opposite two-thirds the length of *Rs*, *Sc*<sub>2</sub> near its tip; *m-cu* from approximately two-thirds to fully its own length before fork of *M*.

Abdominal segments obscure yellow, the lateral margins narrowly, the posterior borders more broadly, infuscated; on subterminal segments the dark colour more extensive; hypopygium yellow. Male hypopygium with the caudal margin of tergite convexly rounded. Basistyle with

ventromesal lobe simple except for a low basal lobule. Dorsal dististyle a powerful rod, more thickened before the abruptly narrowed spinous tip. Ventral dististyle oval, fleshy; rostral spines two, slightly separated at base, shorter than the prolongation beyond the point of insertion of the outer spine. Gonapophysis with tip of mesal-apical lobe narrowly darkened, suddenly narrowed into a small blackened point.

*Hab.* Ecuador (Ayacucho).

*Holotype*, ♂, Yanamonte, La Mar, in fog forests, altitude 3000–4100 metres, September 29, 1941 (Woytkowski).

*Limonia* (*Rhipidia*) *thysbe* is one of rather numerous species of the subgenus in the Neotropics that have the wing-pattern arranged much as in *L. (R.) domestica* (Osten Sacken). It differs from such allied forms in the short-unipectinate flagellum of the male antennæ, with the subterminal segments unbrightened; the strong differentiation in colour of the fore femora from the other two pairs; the restricted wing-pattern, including no dark colour in cells *R* and *M* at near the middle of their length; and in the structure of the male hypopygium.

*Limonia* (*Geranomyia*) *sumptuosa*, sp. n.

Size large (wing, male, over 11 mm.); general coloration dark plumbeous grey, the præscutum with two velvety black stripes; halteres with blackened knobs; femora black, with a narrow yellow subterminal ring; wings whitish subhyaline, conspicuously patterned with clear-cut brown areas; *Sc* long; *Rs* spurred at origin; abdomen black; male hypopygium with the ninth tergite notched; rostral spines short, arising from a low common tubercle.

*Male*.—Length, excluding rostrum, about 8.5 mm.; wing, 11.8 mm.

Rostrum and palpi black; rostrum evidently elongate but the distal portion broken in the unique type and the total length thus unknown; the part remaining is almost as long as the combined head and thorax, indicating an organ of unusual length. Antennæ broken. Head with anterior vertex light grey; posterior vertex dark plumbeous grey; a blackish spot on posterior portion of anterior vertex.

Pronotum dark grey, with a narrow, velvety black, median vitta and more diffusely darkened sides. Mesonotal præscutum with the ground-colour dark grey, with two conspicuous velvety black longitudinal stripes, one on either side of the broad median ground stripe, the latter with vague indications of a still darker but very diffuse central line; humeral region with an oval ochreous spot; the usual lateral præscutal stripes bordered laterally and behind the humeri with darker grey; posterior sclerites of notum dark grey, the median region of scutum pale, the mesal and lateral portions of scutal lobes more darkened; scutellum dark grey, the parascutella more brownish. Pleura chiefly blackened; pruinose, vaguely patterned with lighter grey on the more ventral pleurites. Halteres with stem white, knob abruptly blackened. Legs with coxæ and trochanters dark plumbeous grey; femora black, with a very narrow but conspicuous yellow subterminal ring, this approximately four times its own length from the tip; femoral bases, especially the fore pair, somewhat paler; tibiæ and tarsi brownish black, the tips of former and outer segments of latter blackened. Wings whitish subhyaline, conspicuously and heavily patterned with dark and paler brown, the areas restricted but very clearly defined; a major costal series, the second at the supernumerary cross-vein in cell *Sc*, third above origin of *Rs*, narrowed in cell *C*; fourth area small and irregular in outline, at fork of *Sc*; last area at stigma behind reaching vein  $R_{4+5}$ ; cord and outer end of cell 1st  $M_2$  narrowly seamed with brown; elsewhere scattered brown spots over much of the wing, chiefly restricted to the vicinity of the veins, larger and more diffuse in outer portions of cells *Cu*, 1st *A* and 2nd *A*; cells *M*,  $M_4$  and *Cu*, except at outer ends, washed with pale brown; subcostal interspaces more yellowish; veins brown, brightened in the subcostal and radial interspaces. Venation: *Sc* long,  $Sc_1$  ending about opposite three-fourths the length of *Rs*,  $Sc_2$  at its tip; *Rs* angulated and long-spurred at origin; basal section of  $R_{4+5}$  arcuated, restricting *r-m*; outer section of  $R_{4+5}$  bent strongly cephalad at base; cell 1st  $M_2$  relatively long, subequal to vein  $M_{1+2}$  beyond it; *m-cu* at fork of *M*.

Abdomen, including hypopygium, black, sparsely pruinose. Male hypopygium with caudal border of ninth

tergite conspicuously notched, forming obtusely rounded lateral lobes. Basistyle with ventromesal lobe obtuse, provided with long conspicuous setæ. Dorsal dististyle a strongly curved hook, its tip acute. Ventral dististyle large and fleshy, its area exceeding twice that of the basistyle; rostral prolongation slender, the two short, straight, spike-like spines at summit of a low common tubercle, placed one just behind the other; spines only a little longer than the tubercle and much shorter than the distal portion of the prolongation. Gonapophysis with mesal-apical lobe expanded into a weak flange shortly before the narrowed tip.

*Hab.* Peru (Junin).

*Holotype*, ♂, Tulumayo Valley, Tarma, altitude 4000–8000 ft., October 10, 1940 (*Woytkowski*).

*Limonia* (*Geranomyia*) *sumptuosa* is very distinct from all other regional species of the subgenus. From such other forms of large size and having conspicuously-patterned wings, including *L. (G.) dstricta* Alexander, *L. (G.) gaudens* (Alexander), *L. (G.) laudanda* Alexander, *L. (G.) subgaudens* Alexander, and *L. (G.) uberis* Alexander, the fly is readily distinguished by the coloration of the body, legs and wings, and by the structure of the male hypopygium.

*Limonia* (*Geranomyia*) *neogaudens*, sp. n.

Allied to *gaudens*; general coloration grey, the præscutum with three black stripes, the median one wider than the grey interspaces; knobs of halteres black; femora brown, deepening to a conspicuous, dark brown annulus that is preceded and followed by yellow rings, the terminal one very narrow; stigma uniform pale brown, not encircled by darker brown; vein 2nd *A* sinuous; abdominal tergites reddish brown, the sternites blackened, restrictedly patterned with yellow.

*Female*.—Length, excluding rostrum, about 9–10 mm.; wing 12.5–13 mm.; rostrum about 5.5–6 mm.

Rostrum elongate, exceeding one-half the length of body, black throughout. Antennæ black throughout; flagellar segments long-oval to subcylindrical; terminal segment pointed. Head brownish grey; anterior vertex buffy, relatively narrow, less than the diameter of scape.

Pronotum buffy brown, brownish black on sides. Mesonotal præscutum grey, with three black stripes, the

median one wider than the grey interspaces, the latter more suffused behind; lateral præscutal borders broadly blackened; humeral region conspicuously orange; posterior sclerites of notum dark grey, more or less variegated with black, including the posterior border of postnotum. Pleura brownish grey, patterned with black, especially as a longitudinal stripe across the ventral anepisternum, with a similar but less distinct area on ventral sternopleurite. Halteres with stem whitened, knob black. Legs with coxæ dark brown, sparsely pruinose, fore coxæ more blackened, the tips restrictedly yellow; trochanters yellowish brown; femora brown, deepening to a conspicuous dark brown subterminal ring, preceded by a much narrower yellow ring, the actual tip still more narrowly pale; tibiæ brown, the tips more darkened; tarsi passing into black. Wings cream-coloured, handsomely patterned with brown, much as in *gaudens* but with the areas differently arranged; area at supernumerary cross-vein in cell *Sc* not involving cell *C*; dark seam along *Rs* continuous or virtually so; stigma uniform pale brown, not encircled by darker brown; seams and washes in cells and along veins more extensive, restricting the pale colour; dark seam along vein *M* occupying more than the outer third of vein and with a very gradual beginning. Venation: 2nd *A* more sinuous.

Abdominal tergites reddish brown, including the genital shield, the subterminal segments a trifle darkened; sternites much more blackened, the central portion of the basal segment and the caudal borders of the succeeding sternites yellow.

*Hab.* Peru (Ayacucho).

*Holotype*, ♀, Lake Rasvilca, Huanta, Huanta, altitude 3800 metres, April 16, 1941 (Woytkowski). *Paratopotype*, ♀, April 18, 1941.

*Limonia* (*Geranomyia*) *neogaudens* is related to both *L. (G.) gaudens* (Alexander) and *L. (G.) subgaudens* Alexander, differing from both especially in the details of pattern and venation of the wings, and in the body-colouration.

*Limonia* (*Geranomyia*) *inquisita*, sp. n.

Size small (wing, male, 6 mm.); mesonotal præscutum reddish yellow with a single median brownish-black vitta, subtended on either side by slightly more pruinose lines; halteres with brownish-black knobs; femora obscure yellow with a blackened subterminal ring; wings with a

brownish tinge, very restrictedly patterned with darker, including areas at the supernumerary cross-vein in cell *Sc*, a common mark at origin of *Rs* and fork of *Sc*, and the stigma; *Sc* short, *Sc*<sub>2</sub> ending about opposite the origin of *Rs*; male hypopygium with the ventral dististyle large, its rostral prolongation short, with two conspicuous spines from very unequal tubercles, one of the spines with a tubercle that is approximately four-fifths its own length; gonapophyses with mesal-apical lobe appearing as a curved dark-coloured hook, its tip acute.

*Male*.—Length, excluding rostrum, about 5.5 mm.; wing 6 mm.; rostrum about 2.5 mm.

Rostrum moderately long, nearly one-half the length of remainder of body, black. Antennæ black throughout, short; flagellar segments oval, with inconspicuous verticils; terminal segment about one-third longer than the penultimate. Head dark grey, including a median line on posterior vertex, on either side of which is a conspicuous blackened area; anterior vertex reduced to a narrow strip.

Pronotum dark brown. Mesonotal præscutum chiefly obscure reddish yellow, with a single median brownish-black vitta that does not reach the suture behind, the vitta subtended on either side by a somewhat more pruinose line but not trivittate as is common in members of the subgenus; scutal lobes extensively dark brown, bordered by paler brown, the median line narrowly more whitened; scutellum medium brown, sparsely pruinose; postnotum more reddish brown; mesonotum with setæ of præscutum and scutum relatively sparse but long and erect. Pleura reddish brown, the dorsal pleurites darker brown. Halteres with stem obscure yellow, clearer at base, the knobs brownish black. Legs with coxæ and trochanters obscure yellow; femora obscure yellow or brownish yellow, with a conspicuous black subterminal ring; tibiæ and tarsi brown, the terminal tarsal segments more blackened. Wings with a brown tinge, very restrictedly patterned with darker, including areas at the supernumerary cross-vein in cell *Sc* and a common mark at origin of *Rs* and fork of *Sc*; stigma oval, paler brown; cord and outer end of cell 1st *M*<sub>2</sub> not patterned with darker; veins brown, those in prearcular field somewhat more yellow. Venation: *Sc*<sub>1</sub> ending opposite or just beyond origin of *Rs*, *Sc*<sub>2</sub> at its tip; cell 1st *M*<sub>2</sub> about as long as vein *M*<sub>1+2</sub> beyond it; *m-cu* close to fork of *M*.

Abdomen, including hypopygium, dark brown, the

incisures paler. Male hypopygium with the tergite transverse, the caudal margin very gently emarginate; lateral lobes very low, each with several conspicuous setæ. Dorsal dististyle a gently-curved darkened rod, the acute tip decurved. Ventral dististyle large, from three to four times the area of the basistyle; rostral prolongation short, subcultrate in outline; rostral spines two, placed side by side at near mid-length of the prolongation, both from basal tubercles; one spine from an unusually long tubercle that is fully four-fifths the length of the spine itself; second spine stouter and more flattened, gently curved, from four to five times as long as its tubercle. Gonapophyses with mesal-apical lobes appearing as slender, curved, dark-coloured hooks, their tips acute.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Ayna, La Mar, altitude 2400 metres, April 25, 1941 (Woytkowski).

*Limonia* (*Geranomyia*) *inquisita* is very different from all described regional members of the subgenus, in some regards approaching *L. (G.) conquisita* Alexander, but differing in all details of coloration and structure of the male hypopygium.

*Limonia* (*Geranomyia*) *heteroxipha*, sp. n.

Allied to *cerberus*; general coloration brownish black, the præscutum scarcely patterned; halteres and legs blackened, the tarsi paling to brown; wings with a very strong blackish tinge, the oval stigma somewhat darker; *Sc*<sub>1</sub> ending about opposite one-third the length of *Rs*; male hypopygium very large, especially the ventral dististyle; rostral prolongation with two very unequal spines, the outermost long and straight, from a powerful basal tubercle, the inner spine delicate and curved on its distal portion.

*Male*.—Length, excluding rostrum, about 10 mm.; wing 9 mm.; rostrum at least 4.5 mm.

Rostrum black throughout, elongate, the tip broken in the unique type, the organ evidently about one-half the length of the body; palpi black. Antennæ black throughout; flagellar segments subcylindrical, the verticils shorter than the segments; five terminal segments all about equal in length. Head brownish black, restrictedly patterned with more greyish, including the anterior vertex and narrow median and orbital lines on posterior vertex; anterior vertex narrow, less than one-half the diameter of scape.

Pronotum black. Mesonotal præscutum almost uniform



brownish black, with vague indications of a slightly darker median vitta; scutal lobes brownish black, the median area, with the base of scutellum, testaceous; posterior border of scutellum, with the mediotergite, brownish black. Pleura and pleurotergite dark brown, restrictedly patterned with brownish black on the dorsopleural membrane, anepisternum, and somewhat less distinctly, on the ventral sternopleurite. Halteres blackened, the extreme base of stem yellow. Legs with the coxæ and trochanters brownish black; femora and tibiæ black, the bases of femora a trifle brightened; tarsi paling to brown. Wings with a very strong blackish tinge, the oval stigma somewhat darker; very narrow to scarcely indicated darkenings along cord and origin of *R*<sub>5</sub>; veins brownish black. Venation: *Sc* of moderate length, *Sc*<sub>1</sub> ending about opposite one-third the length of *R*<sub>5</sub>, *Sc*<sub>2</sub> near its tip; cell 1st *M*<sub>2</sub> subequal in length to vein *M*<sub>1+2</sub> beyond it; *m-cu* at or shortly before fork of *M*.

Abdomen, including hypopygium, black. Male hypopygium (fig. 7) very large. Ninth tergite, *9t*, conspicuously notched, the obtusely rounded lateral lobes with abundant long coarse setæ. Basistyle, *b*, relatively small, the ventromesal lobe elongate but unmodified. Dorsal dististyle a curved sickle, gradually narrowed to the long acute tip. Ventral dististyle, *vd*, a very large fleshy lobe, in area fully four times the basistyle; rostral prolongation relatively short, with two very unequal spines, the outer one a strong straight spine from an elongated basal tubercle, the spine approximately twice the length of the tubercle; second spine much more delicate, gently curved at tip, placed at base of prolongation, with no basal tubercle. Gonapophysis, *g*, with mesal-apical lobe long and gently curved, the tip a trifle expanded, obtuse.

*Hab.* Peru (Ayacucho).

*Holotype*, ♂, Sivia, in jungle, altitude 790 metres, June 25, 1941 (Woytkowski).

*Limonia* (*Geranomyia*) *heteroxipha* is most nearly related to *L. (G.) cerberus* Alexander (Mexico-Panama), differing very conspicuously in the structure of the male hypopygium. The superficially similar *L. (G.) contorta* Alexander and *L. (G.) lachrymalis* (Alexander) are more distantly related.

*Limonia* (*Peripheroptera*) *cynara*, sp. n.

General coloration of body polished black, including the entire præscutum; head, median portion of scutum,

the scutellum, and parts of the thoracic pleura grey pruinose; fore femora black, the proximal fifth light yellow; middle and hind femora yellow, the outer fourth darkened, the tips passing into black; wings subhyaline, handsomely patterned with brown, including major areas at arculus, along cord, outer end of cell 1st  $M_2$  and the wing-tip; cell 1st  $M_2$  small, shorter than vein  $M_4$  beyond it; abdomen black, the incisures of tergites with very narrow bands of grey pubescence.

*Female*.—Length about 5 mm.; wing 6 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval, becoming more elongate outwardly; verticils exceeding the segments in length. Head black, heavily silvery grey pruinose, more blackened behind the antennal bases and on the genæ; anterior vertex wide, approximately three times the diameter of scape.

Pronotum polished black, the posterior border very restrictedly brightened. Mesonotum chiefly polished black, the præscutum entirely so, the median region of scutum and the scutellum heavily pruinose. Pleura black, sparsely pruinose, more extensively so on the mesepimeron, the ventral anepisternum and ventral sternopleurite extensively polished black. Halteres with knob black, stem slightly brightened, especially at base. Legs with coxæ polished black, the distal end of fore coxæ restrictedly brightened; trochanters black; fore femora black with about the proximal fifth abruptly light yellow; middle and posterior femora chiefly yellow, the outer fourth more darkened, the tips passing into black; extreme bases of posterior femora darkened; tibiæ brown, the tips narrowly blackened; tarsi black. Wings subhyaline, handsomely patterned with brown, including a major area at and beyond arculus in bases of cells  $R$  and  $M$ ; a broad band extending from the stigma across the cord; outer end of cell 1st  $M_2$  and  $Sc_2$  darkened; wing-tip broadly but somewhat less intensively infuscated; veins dark, slightly brightened in the costal and prearcular fields. Venation: total prearcular field only a little shorter than vein  $M$  before its fork;  $R_3$  very short, oblique, less than the very strongly-arcuated basal section of  $R_{4+5}$ ; free tip of  $Sc_2$  and  $R_2$  very faint, about in transverse alignment; cell 1st  $M_2$  small, shorter than vein  $M_4$  beyond it;  $m-cu$  at fork of  $M$ ; cell 2nd  $A$  moderately wide, slightly constricted at near mid-length.

Abdomen black, the incisures of the tergites with very narrow bands of grey pubescence ; genital segment black ; valves of ovipositor reddish yellow, the cerci blackened basally, very slender, only gently upcurved..

*Hab.* Peru (Ayacucho).

*Holotype*, ♀, Ayna, La Mar, altitude 2400 metres, April 23, 1911 (Woytkowski).

*Limonia* (*Peripheroptera*) *cynara* has the wing-pattern and venation somewhat as in *Limonia* (*Peripheroptera*) *angustifasciata* Alexander, of Venezuela, but differs conspicuously in the coloration of the body and legs. From the other polished black species of the subgenus, the fly differs conspicuously in the wing-pattern and venation.

LXIII. —*Two New Species of Systena, Halticinae (Coleoptera) from the West Indies.* By G. E. BRYANT, F.R.E.S., Imperial Institute of Entomology.

THE genus *Systena* is very largely represented in North, Central and South America. At present there are only six species described from the West Indies, and one of these, *S. ornata* Baly, is a synonym of *S. basalis* Jacq. Duv. I now add two new species, one of which is represented by three specimens in the Chevrolat Collection, British Museum, bearing the MS. name *S. therminieryi* Dej. The types are in the British Museum.

*Systena basalis* Jacq. Duv. Hist. Phys. Cub. p. 312 ; Suffr. Wieg. Arch. 1868, i. p. 212. Cuba.

—*ornata* Baly. —Tr. Ent. Soc. Lond. 1877, p. 288. Jamaica.

*S. bicolor* Jac.—Tr. Ent. Soc. Lond. 1897, p. 263. St. Vincent.

*S. cæruleipennis* Suffr.—Wieg. Arch., 1868, p. 213. Cuna.

*S. S-littera* Linn.—Syst. Nat. ed. x. p. 373. Surinam and W. Indies.

*S. varia* Wsc.—Wieg. Arch. Naturg. 1885, p. 164, pl. vii. fig. 9. Porto Rico.

*Key to the West Indian Species of Systena.*

- 1 (6). Head and prothorax flavous.
- 2 (7). Elytra with very fine punctures.
- 3 (4). Elytra dark brown, with a pale longitudinal S-shaped stripe..... *S-littera* L.

- 4 (3). Elytra dark brown, with a double longitudinal pale stripe joined at the apex.
- 5 (8). Elytra without maculae..... *varia* Wse.
- 6 (1). Head and prothorax obscurely cupreous.
- 7 (2). Elytra with rather strong confused punctures.
- 8 (5). Elytra with two pale maculae, one at the base and one at the apex, the apex with a pale margin..... *basalis*, Jacq Duv.  
= *ornata* Baly.  
*cæruleipennis* Suffr.
- 9 (11). Elytra unicolorous blue.....
- 10 (18). Elytra not unicolorous blue.
- 11 (9). Elytra unicolorous black or varying in having only the apical portion black.
- 12 (13). Prothorax fulvous, with the sides not margined with black..... *trinitatis*, sp. n.
- 13 (12). Prothorax fulvous, the sides margined with black.
- 14 (17). Prothorax not flavous.
- 15 (16). Elytra black, with a flavous spot on each. *bicolor* Jac.
- 16 (15). Elytra flavous, with a black spot on each.
- 17 (14). Prothorax flavous, the sides margined with black.
- 18 (10). Basal half of the elytra with a longitudinal stripe, not touching the side-margins, a black spot on each elytron behind the middle..... *therminieri*, sp. n.

*Systena trinitatis*, sp. n.

Elongate, nitid fulvous, with the apex of the elytra black, or varying in being entirely black, the sides of the prothorax slightly contracted towards the base, the antennæ long and slender, extending to the middle of the elytra.

Length 3.5 mm.

Head fulvous, impunctate, a slight transverse impression between the eyes. Antennæ fulvous, long and slender, extending to the middle of the elytra, the two basal segments thickened, the first segment twice as long as the second, the third long and slender, twice as long as the second, the remainder each about equal to the third. Prothorax fulvous, nitid, slightly broader than long, the sides feebly margined and slightly contracted behind the middle towards the base, a feeble transverse impression near the base. Scutellum fulvous, nitid, triangular. Elytra elongate, nitid, sides nearly parallel, but wider behind the middle, rounded at the apex, fulvous with the apical portion black, or entirely black. Legs entirely fulvous. Underside fulvous, the apical ventral segment of the abdomen the longest.

BRITISH WEST INDIES : Trinidad, 1918 (*C. B. Williams*), 14 specimens.

Somewhat allied to *S. bicolor* Jac., from St. Vincent and Grenada, but a larger species, more nitid, and the pattern differs. *S. bicolor* appears not to vary to the extent of the elytra becoming entirely black. It is also allied to *S. ustulata* Har., from New Granada, which has the side-margins and suture of the elytra black.

*Systema therminieri*, sp. n.

Elongate, pale flavous, the side-margins of the prothorax black. Elytra with a black longitudinal stria not touching the side-margins, and extending slightly beyond the middle, a black spot behind the middle on each elytron. The posterior femora with the apical portion black.

Length 3 mm.

Antennæ pale flavous, extending just beyond the middle of the elytra, the first segment the longest and more dilated, the second much shorter and about equal to the third, the fourth to the seventh about equal, each a little longer than the third, the eight to the tenth about equal and each a little shorter than the seventh, the eleventh a third longer than the tenth and acuminate, the four terminal segments tinged with fuscous. Head flavous, impunctate. Prothorax flavous, margined with black, rugosely punctured, with a slight basal transverse impression, clothed with scattered golden pubescence, slightly broader than long, the anterior angles oblique. Scutellum triangular, black, impunctate. Elytra broader than the prothorax, narrowly oblong, strongly punctate-striate, pale flavous clothed with scattered golden pubescence, a black stria parallel with the side-margins, not touching the margins, extending slightly beyond the middle, a black spot behind the middle on each elytron. Legs pale flavous, the posterior femora with the apical portion black. Underside pale flavous, impunctate, the apical segment of the abdomen the longest. Male with the first segment of the anterior tarsi slightly dilated.

WEST INDIES : Leeward Is., Guadeloupe, 3 specimens from the Chevrolat Collection in British Museum, labelled *S. therminieri* Dej.

WEST INDIES : Trinidad, January, 1903 (*G. E. Bryant*), 6 specimens.

Allied to *S. C-nigrum* Jac., from Paraguay, but differs in the markings, also less nitid, and the stronger puncturation of the elytra.



A

1 cm.



B

3.5 cm.

A. *Whiteichthys greenlandicus*, gen. et sp. nov.  
Holotype. Pc 42A.

B. *Aldingeria biertheri*, gen. et sp. nov.  
Holotype. Pc 129.



# THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

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LXIV.—*Entomological Expedition to Abyssinia, 1926–27.*  
*Coleoptera*, Curculionidæ; Apioninæ. By J. BALFOUR-  
BROWNE, M.A., F.Z.S., F.R.E.S., Department of  
Entomology, British Museum (Natural History).

THE Abyssinian Apioninæ have been in part worked out by Hustache \* but, as he there states, many of the specimens were left unidentified. There are hereinafter described five new species of *Piezotrachelus*, ten new species of *Apion* and one new species of *Ceratapion*. The known *Piezotrachelus* from Abyssinia now number eleven species, seven of which are apparently endemic, two are also known from Eritrea, one was recently described from the mountainous Ruanda District of the Belgian Congo, and one is of widespread occurrence throughout East and South Africa. The known *Apion* (*sensu lato*) from Abyssinia are here increased to 24 species, fifteen of them are apparently endemic, one is Palearctic (*radiolus* Kirby), four are also known from Eritrea, and four are of widespread occurrence in East and South Africa, although apparently uncommon in Abyssinia. A further nine species, represented by unique females (*Piezotrachelus*, 2; *Apion*, 7), remain undescribed. One species of *Apio-morphus*—*corvinus* VOSS—is endemic.

\* A. Hustache, *Ann. & Mag. Nat. Hist.* (10) xviii. 1936, pp. 497–501.



The total apparent endemicity for the area is thus 23 species out of 36 described Apioninæ, or about 64 per cent., an astonishingly high figure, and the apparent fact that only six species out of a total of 36 are also found in neighbouring Eritrea, where fourteen described species are known, is also unexpected. Only one of the five species otherwise widespread in Africa appears common in Abyssinia, to judge by the numbers of specimens in the collection :—*P. fuliginosus* Wagn., 61 specimens ; *A. constrictum* Htm., 5 specimens ; *A. fortirostre* Wagn., 1 specimen ; *A. spadiceum* Wagn., 1 specimen ; *A. (Conapion) cyladoides* Htm., 1 specimen.

In the absence of any particulars as to host-plant specificity of members of this subfamily, and even of valid information as to any plants on which the various species were taken, there is no available information to account for the high apparent endemicity, especially as all the species are fully alate. Parallel studies on the mountain-masses of the Sudan, Eritrea and East Africa, and also on the Arabian mountains, are obviously desirable as tending to throw light on the question of endemicity at high altitudes in the mountains in this area. There is no indication that any of these insects are associated with the arborescent Euphorbias, Lobelias or Senecios, which might account for some of the degree of localisation were any such association noted. Scott \* mentions no member of this subfamily in the list of Curculionidæ known to be associated with this flora in East Africa †.

To avoid reiteration, I have omitted the collectors' names in the information as to distribution in all cases where the material is from the Entomological Expedition of 1926-7, of which Dr. Hugh Scott and Mr. J. Omer-Cooper were the members.

Measurements in all cases are taken to exclude the rostrum.

I would like to express my sincere thanks to Sir Guy Marshall for much help and advice in the preparation of this paper.

\* Scott, Journ. Linn. Soc. Lond., Zool. (39), 1935, p. 241.

† [The Apioninæ collected during the Expedition to Abyssinia were obtained mainly by sweeping or beating mixed vegetation. In the few cases where I observed the association of specimens with particular trees or plants, or any other bionomic fact, my notes are given in inverted commas under the locality-lists.—HUGH SCOTT.]

*Piezotrachelus pseudofuliginosus*, sp. n. (Fig. 1 a.)

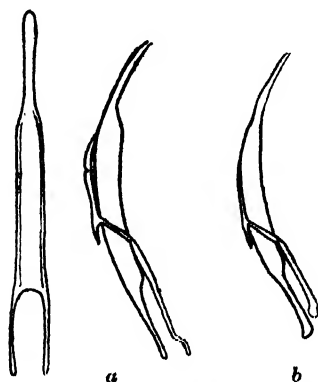
*Apion* (*Piezotrachelus*) *fuliginosum* Wagn., Hustache ex parte, Ann. & Mag. Nat. Hist. (10) xviii. 1938, p. 500.

♂♀. Black, not very shining, the surface microscopically reticulate, with extremely short fine hairs arising from very fine punctures which tend to be linear on the elytral interstriae.

*Head* about as long as wide (1.6 : 1.7), the eyes not very prominent, the frons as wide as the base of the rostrum, strongly reticulate with shallow scattered punctures on the frons and vertex, the frons with a very shallow longitudinal depression on either side of the middle line which is barely tectiform; temples short, one-third the diameter of the eye, vaguely rugose, reticulate. *Rostrum* stout, very weakly curved, cylindrical, shorter than head and pronotum together but longer than the pronotum alone, dorsally at the base distinctly reticulate, towards the apex progressively more obsoletely so, the extreme apex quite shining, with a distinct but sparse shallow punctation, the basal punctures with short white setae; basi-laterally in front of the eyes with two vague longitudinal sulci which fuse and fade out just above the antennal insertion; rostrum of the female very little longer than that of the male. *Antennae* piceous, the basal segments more flavous, inserted at one-third from the base of the rostrum; the scape little longer than the basal segment of the funicle, which is about two-fifths longer than the second segment, the third to seventh segments progressively shorter, the seventh about as wide as long. *Pronotum* broadest at the base, not much longer than wide, the apex one-third narrower than the base, the straight sides converging to two-thirds of their length, where there is a moderately strong constriction; the surface finely and evenly, but not densely punctured, with a short distinctly impressed median dorsal longitudinal stria just in front of the base; dorsally distinctly, laterally more obsoletely (except in the constriction) reticulate; each puncture giving rise to a very short white seta; dorsal outline weakly convex. *Scutellum* very short and round, flat, reticulate. *Elytra* elongate-oval, laterally gently rounded, widest at the middle, the humeral callus distinct; dorsal outline strongly convex, highest at the middle; the striae, particularly the discal ones, moderately impressed, the punctures well

separated, striae 1 and 2 uniting with 9, these deeply impressed posteriorly; intervals very weakly convex or flat, shagreened. *Venter*: metasternum shagreened, laterally with large, shallowly impressed punctures; 5th abdominal segment of the male strongly and densely punctured, each puncture with a strong silvery-white hair; of the female,

Fig. 1.



a. *P. pseudofuliginosus*, sp. n.; b. *A. (P.) fuliginosus* Wagn.

laterally strongly punctured and with a deep median fovea. *Legs* long and slender, the hind-femora reaching the apex of the elytra; a sexual dimorphism present in the form of a very short spine on the inner posterior edge of the basal hind-tarsal segment of the male, this spine hardly exceeding the clothing sucker hairs in length; basal mid-tarsal segment apparently simple.

*Length*, 2.36–2.68 mm.

ABYSSINIA: Mulu, above Muger Valley, circa 8,000 ft., 18–23, xii. 1926, 5 ♂, 4 ♀.

UGANDA: Kampala 11. xii. 1936, "On Coffee." 1 ♂ (*H. Hargreaves*).

This species was confused with the series of *fuliginosus* Wagn. by Hustache. It is very close to that species but the rostrum is stouter, not apically narrowed; the apparent absence of a mid-tarsal spur distinguishes the male and the denser punctuation of the fifth abdominal venter further distinguishes that sex. In the female the fifth abdominal venter is larger than in the compared species

and distinctly broader ; both are foveate. From *tubulatus* Fhs., of which I have seen only the female, this species differs by the shorter, more curved rostrum, which is also less copiously and more finely punctured, the paler antennal segments and the fovea of the fifth abdominal venter ; *tubulatus* is non-foveate.

The ædeagus is very close to that of *fuliginosus* but the whole organ is broader, the apical narrowed tongue very distinctly so, and this portion, seen laterally, is straight, not at all undulate before the apex.

*Piezotrachelus milkoi*, sp. n.

*Apion* (*Piezotrachelus*) *fuliginosum* Wagn., Hustache ex parte. loc. cit.

♂♀. Black, not very shining, distinctly elongate, clothed with very short silvery-white hairs.

*Head* wider than long (1·7 : 1·3), the eyes moderately prominent, the facets large, the frons as wide as the base of the rostrum, reticulate, obsoletely punctured, somewhat depressed ; temples rather short, about one-quarter of the diameter of the eye, vaguely rugose, reticulate. *Rostrum* of male nearly as long as head and pronotum together, very weakly curved, cylindrical, irregularly but rather closely punctured, the punctures rather superficial, obsoletely reticulate except at the base where the meshes are distinctly impressed ; of female one-and-a-half times as long as head and pronotum together, cylindrical, very weakly curved, sculptured similarly to the male. *Antennæ* of male inserted three-eighths from the base of the rostrum, piceous, scape one-fifth longer than the basal segment of the funicle, which is about twice as long as wide, the second segment about the same length as the first, narrower, 3-6 progressively shorter, 7th globular ; of female inserted rather less than one-third from the base of the rostrum, piceous, longer and more slender than in the male ; scape twice as long as the basal segment of the funicle, which is very slightly shorter than the second segment, the first segment being a little less than twice as long as wide ; third segment very little shorter than the first, second as long as 4+5 or 5+6, 7th square. *Pronotum* as long as wide at the base, the apex one-fifth narrower than the base, a strong constriction at the sides sub-apically, the sides basal to the constriction weakly convex ; the surface microreticulate, more obsoletely on the sides, with scat-

tered large but shallow punctures, an impressed median dorsal longitudinal stria in front of the scutellum reaching nearly half the length of the pronotum (this is not absolutely consistent, some specimens having a vaguely foveiform impression); dorsal outline weakly convex or straight. *Scutellum* short, triangular, as long as wide at the base, surface flat, reticulate. *Elytra* elongate, laterally moderately convex, widest at middle, humeral callus distinct; dorsal outline not highly convex, highest at middle; the striae well impressed, 1 and 2 uniting with 9 at apex; intervals weakly convex, reticulate rugose. *Venter*: metasternum reticulate with a few very shallowly impressed punctures near the sides; 5th abdominal segment of the male with scattered setiferous punctures obscured by a strong reticulation; of the female broadly triangular with a large shallow median fovea, more finely and obsoletely punctured and reticulate than the male. *Legs* not very long, hind-femora not reaching apex of the elytra; basal segment of the four posterior tarsi of the male with a short stout ventral apical spine, barely projecting beyond the surface clothing. A sexual dimorphism occurs in the elytra which, at the sutural apices in the male, are widely rounded, but in the female are produced, rectangular.

*Length*, 2.0–2.41 mm. (one particularly robust female attains 2.54 mm., but this is exceptional).

ABYSSINIA: Wachacha ravine, near Addis Ababa, circa 8,000 ft., 9. ix. 1926, 1 ♂, 1 ♀; Addis Ababa, British Legation. 10. ix. 1926, 1 ♀; Mulu, above Muger Valley, circa 8,000 ft., 18–23. xii. 1926, 3 ♂, 1 ♀; Mt. Chillalo, forest, circa 8,500 ft., 22. xi. 1926, "from flower spikes of *Buddleia polystachya* Fres.," 1 ♂; same locality (but no host-plant record), 24. xi. 1926, 3 ♂, 2 ♀; Jem-Jem Forest, circa 8,000 ft., 25–29. ix. 1926, 1 ♂, 1 ♀; Mt. Zukwala, circa 9,000 ft., 22. x. 1926, "by sweeping rushes in lake," 1 ♀, "beaten from trees near lake shore." 1 ♂, "forest near highest point," circa 9,665 ft., 23. x. 1926, 2 ♂.

This species is named after the late Milko Guyo, a very capable Abyssinian in Addis Ababa, who got together many of the men for the caravan. It much resembles *P. usambarensis* Hartm., of which only a single female is available for comparison, in the not very high convexity of the elytra, the elongate form and deeply impressed

elytra striæ. But in this sex the very much greater length of the rostrum, the rectangular sutural angle of the elytra, the shorter scutellum and the distinct, deep fovea of the fifth abdominal venter distinguish the species readily. Hartmann's description of *usambarensis* (1908) (= *foveicollis* Hartm., 1904, nec Lea, 1898) does not mention the basal segment of the four posterior tarsi as being sexually dimorphic.

*P. milkoï* is very near *cinchonæ* Burg., of which I have seen female cotypes, but the rostrum is more slender, the elytral convexity shallower, the thoracic punctuation coarser and the fovea of the fifth venter deeper, and this segment smaller and narrower. *P. cinchonæ* is also a mountain species. *P. ensiferus* Burg. is also nearly related. In that species the rostrum is longer in the female (6 : 5) and the fifth abdominal venter is non-foveate, the male rostrum is stouter, the elytral striæ less impressed and the ædeagus quite distinct.

*Piezotrachelus fuliginosus* Wagner. (Fig. 1 b.)

*Apion* (*Piezotrachelus*) *fuliginosum* Wagn., Hustache ex parte, loc. cit.

Hustache cites "environ 22 spécimens" from Debra Libanos, Mulu and Mt. Zukwala. Actually of the series identified by him only the Debra Libanos series are pure *fuliginosus*; the Mt. Zukwala specimens are *milkoï*, sp. n., described above, as are also some of the specimens from Mulu; others from Mulu are *pseudofuliginosus*, sp. n., described above, and the remainder are true *fuliginosus* Wagn. Additional specimens have been identified from the series unexamined by Hustache.

ABYSSINIA: Debra Libanos, circa 8,000 ft., 2. i. 1927, 10 specimens; Mulu, above Muger Valley, circa 8,000 ft., 18-23. xii. 1926, 49 specimens; Mt. Chillalo, forest, circa 8,500 ft., 24. xi. 1926, 1 specimen; edge of Jem-Jem Forest, circa 9,000 ft., 4. x. 1926, 1 specimen.

*Piezotrachelus punctisternus*, sp. n.

*Apion* (*Piezotrachelus*) *microcephalum* Hust., op. cit. p. 501 (non Wagner, 1908).

♂♀. Black, rather dull, elytral interstriae vaguely rugose, reticulate, with two rows of very short hairs: lateral parts of metasternum and venter of fused 1st and 2nd abdominal segments coarsely punctured, as are the femora.

*Head* as long as wide, the eyes not very prominent, the frons slightly narrower than the base of the rostrum, vaguely tectiform longitudinally in the middle line with a shallow depression on each side; temples short, one-third the diameter of the eye, coarsely rugosely punctate, reticulate. *Rostrum* of both sexes weakly curved, shorter than head and pronotum together, a little longer than the pronotum alone, reticulate to the apex, with scattered shallow obsolete punctures; basilaterally, in front of the eyes, non-sulcate, strongly microreticulate; that of the male slightly shorter than that of the female (3.6 : 4.0), stouter. *Antennæ* piceous, inserted at one-third from base of the rostrum, the scape one-third longer than the basal segment of the funicle, which is twice as long as wide; second funicular segment three-quarters the length of the basal segment, 3-7 subequal, the 7th as wide as long. *Pronotum* a little wider at base than long, the apex one-third narrower than the base, broadest at the base, the straight sides converging to the apex with a moderately deep constriction at one-third from the apex; the surface finely and evenly but not very densely punctured, each puncture giving rise to a short white hair, distinctly reticulate and having a somewhat greasy sheen; dorsal outline weakly convex. *Scutellum* elongate-oval, obsoletely impressed in the middle, reticulate. *Elytra* elongate-oval, sides weakly rounded, widest at the middle, the humeral callus very distinct; dorsal outline strongly convex, highest before the middle; the striae moderately impressed, the sutural and second more distinctly so, particularly anteriorly and posteriorly, the serial catenulate punctures distinctly impressed; sutural and second striae uniting with ninth posteriorly; intervals flat, strongly shagrinately, dull, vaguely rugose, with two rows of very short silvery-white hairs arising from distinct punctures. *Venter*: the metasternum strongly and coarsely punctured, the punctures well impressed; fused 1st and 2nd segments with scattered coarse punctures, the 5th of the male strongly shagreened, vaguely rugose punctate, of the female broadly triangular, the base reticulate, the sides and apex distinctly and coarsely punctate, non-foveate. *Legs* long but not very slender, the hind-femora reaching the apex of the elytra, all femora rather coarsely punctate, clothed with sparse, moderately long silvery-white hairs. No sexual dimorphism of the tarsi. The sexes may be distinguished by

the rather longer and more slender rostrum of the female and by the venter of the 5th abdominal segment being transverse in the male, triangular in the female.

*Length*, 2.36–2.73 mm.

ABYSSINIA : marsh near Lake Hora Abjata, circa 5,000 ft., 18. xi. 1926, 5 ♂, 5 ♀; Mt. Chillálo, forest, circa 8,500 ft., 24. xi. 1926, 2 ♂, 1 ♀.

This species was identified by Hustache as *A. (P.) microcephalum* Wagner "avec quelque réserve, bien qu'un spécimen mâle de Hora Abjata paraît être identique avec les types (♂) de Wagner dans le British Museum." The series bore a label by Marshall "not *microcephalum*." In addition to the above series, less one male from Mt. Chillálo, Hustache had placed one female from Doukam, two females from Mulu and one male from Wachacha ravine (near Addis Ababa), but these four specimens prove to belong to four other distinct species, none of which is *microcephalus* Wagner. *P. punctisternus* may be distinguished from *microcephalus* by the more obsolete punctuation of the rostrum, the more distinctly impressed punctures of the elytral striæ, the coarse punctures of the metasternum and venter of the 1st and 2nd abdominal segments, the greater convexity of the elytra, the more slender female rostrum, the longer and more slender antennæ, a different form of fifth abdominal venter of the female and by a very different form of ædeagus. The *type* and allotype were selected from the Hora Abjata series.

*Piezotrachelus corax*, sp. n.

♀. Black, dull, moderately convex, eyes moderately prominent, strongly microreticulate. Belongs to the *herbsti-angusti thorax* group.

*Head* one-and-a-half times as long as wide, eyes evenly convex; frons as wide as the base of the rostrum, slightly inflated, impunctate, strongly microreticulate; temples very short, one-fifth of the diameter of the eye, genæ coarsely punctured. *Rostrum* as long as head and pronotum together, strongly curved, slender, cylindrical, reticulate, finely and obsoletely punctured, basilaterally in front of the eye with two shallow sulci, the ridge separating them fading out before the antennal insertion. *Antennæ* slender, piceous, inserted a little more than one-quarter from the base of the rostrum; scape one-third longer than the basal segment of the funicle, which is two-and-a-half times longer



than wide, second segment as long as the first, 3-6 progressively shorter, 7th square. *Pronotum* widest at the base, a little longer than wide, apex very little narrower than the base, lateral constriction moderate; the surface finely but distinctly microreticulate, very finely and sparingly punctured, with a short, shallow foveiform stria in the median dorsal line just in front of the scutellum; dorsal outline distinctly convex. *Scutellum* short triangular, strongly reticulate. *Elytra* broadly oval, humeral callus very distinct, width at calli one-and-a-half times as wide as base of the pronotum, posteriorly broadly rounded, sutural angles nearly rectangular; dorsal outline moderately convex, highest just in front of the middle; striae not very strongly impressed except the sutural, which is strongly impressed anteriorly and posteriorly, 1st and 2nd uniting with 9th posteriorly; interstriae weakly convex, strongly reticulate. *Venter*: metasternum impunctate, reticulate; 5th abdominal segment sub-shining, reticulate with scattered fine punctures, non-foveate. *Legs* not very slender, hind-femora not reaching the apex of the elytra.

*Length*, 2.55 mm.

ABYSSINIA: Mulu, above Muger Valley, circa 8,000 ft., 18-23. xii. 1926, 1 ♀.

This species is intermediate in size between *herbsti* and *angustithorax* (*angusticollis* Gerst. nec Gyll.), but the rostrum is evidently shorter than in either of these species and the curvature is greater, the eyes are more prominent, the thoracic fovea distinct and the elytral apices are nearly rectangular, not smoothly rounded as in *herbsti* nor divaricate-emarginate as in *angustithorax*. The sharp angle of the base of the elytra, owing to their being much broader than the base of the pronotum, and the slender strongly curved rostrum suggest a relationship to *figinii* Wagn. and *insertus* Wagn., which are unknown to me, but in other characters the species is clearly distinct from them according to the descriptions.

*Piezotrachelus erythreanus* Wagner, 1909.

A single specimen that I ascribe to this species, which I have not seen. It is rather similar to *arduus* Wagn., but larger, the rostrum longer and more curved; the 5th abdominal venter has a shallow elongate medio-apical fovea, the sides of the segment coarsely punctured.

ABYSSINIA : Mulu, above Muger Valley, circa 8,000 ft., 18-23 xii. 1926, 1 ♀.

*Piezotrachelus particeps* Wagner, 1909.

Three male specimens which I am by no means satisfied are correctly identified, but they agree tolerably well in structure with two females identified by Wagner from Abyssinia, without more precise locality. The size of the specimens ranges from 1.8-2.0 mm.

ABYSSINIA : lakes of Addas, Hora Bishoftu, 2. xii. 1926, 1 ♂ ; Mt. Zukwala, forest near highest point, circa 9,665 ft., 23. x. 1926, 1 ♂ ; Mulu, above Muger Valley, circa 8,000 ft., 18-23. xii. 1926, 1 ♂.

*Piezotrachelus ruandanus* Burg., 1938.

*Apion* (*Piezotrachelus*) *microcephalum* Hustache ex parte, loc. cit. (nec Wagner).

The male, although having a rostrum distinctly shorter than that of a cotype male I have seen in Marshall's collection, has the aedeagus exactly comparable. The female was identified by Hustache as *microcephalus*. It is not Wagner's species, having a longer, slenderer and more curved rostrum, nor is it *punctisternus*, sp. n., described above, which was also identified by Hustache as Wagner's species. This female agrees quite well with the cotype male and the male from Jem-Jem, and is almost certainly conspecific ; the 5th abdominal venter is strongly micro-reticulate, finely punctate along the sides, non-foveate.

ABYSSINIA : Jem-Jem Forest, circa 8,000 ft., 23. ix. 1926, 1 ♂ ; Doukam, "all from flowers of a tree, *Cordia abyssinica*," 6,500-7,000 ft., 19. x. 1926, 1 ♀.

*Piezotrachelus* sp.

A single female apparently belonging to the *gerstäckeri* complex, several of the species of which are unknown to me.

ABYSSINIA : Muger Valley, circa 5,500 ft., 28-29. xii. 1926, 1 ♀.

*Piezotrachelus* sp.

A unique female belonging to this genus and near *vanderijstianus* Burg., but with rostrum shining and smooth, non-reticulate after the antennal insertion ; rather similar to *Apion* (*Pseudopiezotrachelus*) *atramentarium* Wagn.

ABYSSINIA : Mulu, above Muger Valley, circa 8,000 ft., 18-23. xii. 1926, 1 ♀.

*Piezotrachelus vecors*, sp. n.

♀. Black, dull, elongate, surface strongly microreticulate, a vestiture of excessively short fine white hairs giving a slightly dusty appearance.

*Head* a little longer than wide, the eyes flatly rounded, not at all prominent, barely exceeding the temples; the frons very weakly concave, impunctate, finely reticulate; temples half as long as the eye diameter. *Rostrum* shorter than the head and pronotum together but longer than the pronotum alone, fairly slender, sharply curved, gradually narrowed from base to insertion of antennæ, this space being equal to the diameter of the eye, then parallel-sided to the apex, finely reticulate except at the extreme apex which is smooth and shining, impunctate; basilateral sulcus obsolete. *Antennæ* flavo-piceous, slender, inserted about one-third from the base of the rostrum; scape barely longer than basal funicular segment, which is about twice as long as wide, second segment as long as the first, but much narrower, 3-7 progressively shorter and broader, 7th one-fifth longer than wide. *Pronotum* a little longer than wide, widest at the base, apex not very narrow, the anteapical constriction not very strong; dorsal outline very weakly convex; a median longitudinal stria from the middle nearly to the base in front of the scutellum, somewhat foveiform at the basal end; surface finely punctured. *Scutellum* elongate, narrow, twice as long as wide, with a shallow median impression. *Elytra* elongate-oval, sides gently rounded, widest at the middle, humeral callus moderately prominent; dorsal outline rather strongly convex; striæ deep, the catenate stria punctures well impressed, the interstriae weakly convex, twice as wide as the striæ, 1st joining with 9th, 2nd with 8th and 9th. *Legs* slender, femora reaching the apex of the elytra but not exceeding them. *Venter*: 5th abdominal segment with an elongate median fovea in the basal half.

*Length*, 1.9-2.1 mm.

ABYSSINIA : Mt. Chillálo, forest, circa 8,500 ft., 24. xi. 1926, 2 ♀; Mulu, above Muger Valley, circa 8,000 ft., 18-23. xii. 1926, 1 ♀.

This species appears to be most nearly related to *fronto* Wagn., and *abutilonis* Marshall, but the head is rather

different, the eyes a little projecting beyond the temples and the rostrum is longer and more sharply curved than in *fronto*, distinctly more so than in *abutilonis*. The type is selected from one of the specimens from Mt. Chillálo.

*Apion zukwalaense* Hustache, *op. cit.*, p. 498 (?*Pseudopiezotrachelus*). (Fig. 2 b.)

Hustache says of this species "différences sexuelles secondaires très faibles, le rostre du ♂ un peu plus épais." In point of fact, apart from the transverse 5th abdominal venter of the male and triangular one of the female, there is a definite, easily visible sexual character in the form of the sutural apex of the elytra which, in the male, is produced but the angle is distinctly obtuse, whereas in the female it is distinctly rectangular or even slightly acute. The error appears to originate from the fact that the specimen labelled male type is wrongly sexed, as was first proved by dissection, a female specimen being correctly determined. The species was placed in *Pseudopiezotrachelus* by Hustache, but is hardly a typical member of the subgenus, the transverse impression on the vertex being very obsolete. In the very short prosternum in front of the fore coxæ the species shows a tendency towards *Conapion*, but has not the highly convex elytra and vestige of the 10th stria which characterises that subgenus.

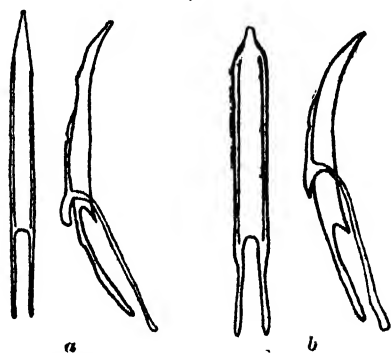
*Apion chilláloense*, sp. n. (?*Pseudopiezotrachelus*). (Fig. 2 a.)

♂. Black, moderately shining, pubescence excessively minute and fine; a vestigial transverse impression on the vertex of the head.

*Head* very little wider than long, the eyes not at all prominent, very weakly convex, barely exceeding the temples; frons very obscurely longitudinally tectiform, finely reticulate, impunctate; temples very short, one-quarter of the diameter of the eye, coarsely punctured. *Rostrum* long, distinctly longer than the head and pronotum together, moderately curved, cylindrical, distinctly wider at base than the frons, strongly microreticulate, finely and obsoletely punctured; basilateral sulci distinct, the space occupied by them distinctly reticulate, longer than the diameter of the eye. *Antennæ* piceous, inserted at one-third from the base of the rostrum, the scape short, no longer than the basal segment of the funicle, which itself is no longer than the second segment, 3-7 progres-

sively shorter and broader, 7th one-and-a-half times as long as wide. *Pronotum* weakly conical, as long as wide at the base, which is of the greatest width, apex not much narrower than the base, strong subbasal and subapical constrictions laterally, which extend dorsally to some extent and almost meet in the middle line; surface strongly but not very densely punctured; a very shallow dorsal subbasal fovea in front of the scutellum. *Scutellum* very short triangular, flat. *Elytra* oval, sides weakly rounded, dorsal outline strongly convex, highest just in front of the middle; discal striae strongly, lateral striae more shallowly impressed, indistinctly catenulate punctured; 1st and 2nd strongly impressed apically, uniting there with 9th; intervals flat, finely reticulate. *Venter*:

Fig. 2.

a. *A. chillaloense*, sp. n.; b. *A. zukwaloense* Hust.

1st and 2nd abdominal segments rather finely and sparsely but distinctly punctured, 5th segment strongly reticulate, indistinctly punctured along the apical margin. *Legs* long and slender, metafemora extending past the apex of the elytra.

*Length*, 2.20–2.25 mm.

ABYSSINIA: Mt. Chillalo, forest, circa 8,500 ft., 24. xi. 1926, 1 ♂; same locality, circa 9,000 ft., 14. xi. 1926, 1 ♂.

This species is very similar to *zukwaloense* Hust., but has the rostrum distinctly longer and less distinctly punctate. The pronotum is similar in both species in possessing the subbasal as well as the subapical constrictions; the 1st and 2nd abdominal venter are more shining and less sharply microreticulate. The aedeagus is absolutely dis-

tinct in the two species, *cf.* fig. 2 *a, b*. It is extremely interesting to find two such closely similar species, the former at the top of the isolated extinct crater of Zukwala, the latter at nearly the same elevation on Mt. Chillálo. Chillálo reaches a much greater height than Zukwala, and the two mountains are separated by some 120 miles of plateau country several thousand feet lower.

*Apion constrictum* Hartm.

Described from TANGANYIKA (Kwai-Usambara Hills) and known to me also from KENYA, PORTUGUESE EAST AFRICA, RHODESIA and ZULULAND. The *ædeagus* is identical in specimens taken throughout the range of the species.

ABYSSINIA: Borū stream, north of Mt. Chillálo, circa 7,500 ft., 29. xi. 1926, 1 ♂; Mt. Chillálo, forest, circa 8,500 ft., 24. xi. 1926, 1 ♂, 2 ♀; plains north-west of Lake Zwai, 5,500-6,000 ft., 31. x.-1. xi. 1926, 1 ♀.

*Apion scotti*, sp. n.

♂. Black, dull, strongly shagreened with a very fine, very short silvery pubescence.

*Head* as long as wide, the eyes not prominent, flatly rounded, the frons about half as wide as the base of the rostrum, flat, strongly reticulate, setiferous punctures very fine and obsolete; temples one-third the diameter of the eye, vaguely rugose. *Rostrum* a little shorter than head and pronotum together, cylindrical, coarsely reticulate except at the apex which is smooth and shining, obsoletely punctured, pubescence more distinct than on remainder of the body; basilateral sulci obsolete, about equal to the diameter of the eye. *Antennæ* inserted at one-third from the base of the rostrum, fuscous, fairly slender; scape twice as long as the basal segment of the funicle which is globular, second segment as long as the first, much more slender, 3-6 progressively shorter, 7th square. *Pronotum* almost cylindrical, a little longer than wide, very weak subbasal and subapical lateral constrictions; dorsal outline weakly convex; fairly dense, fairly strong shallow punctures less obsolete at the sides; coarsely microreticulate. *Scutellum* very small, short, triangular. *Elytra* oval, sides rounded, widest at middle, dorsal outline not very highly convex, highest at middle; humeral callus distinct; striae strongly impressed, catenu-

late punctures distinct, interstriae about two-and-one-half times as wide as the striae, convex, rugose-shagrinata, striae 1 and 2 uniting posteriorly with 9. *Venter*: 5th abdominal segment with coarse setiferous punctures, strongly microreticulate. *Legs* long and slender, hind femora exceeding apex of the elytra.

*Length*, 1.9 mm.

ABYSSINIA: Debra Libanos, circa 8,000 ft., 2. i. 1927, 1 ♂.

Labelled by Hustache as "*Pseudopiezotr. près probum*," which species I do not know. Faust, in his description of that species says: "entirely the form of *benignum* Fst. . . the elytra are more highly longitudinally convex." Compared with cotypes of *benignum*, *scotti* has the elytra much less highly convex; the eyes are much less prominent, whereas *probum* is said to have the eyes "etwas gewölbter" than *benignum*. The species does not belong to the weakly characterised subgenus *Pseudopiezotrachelus*, of which *probum* was cited as subgenotype by Wagner. Seen laterally there is no indication of the transverse impression on the vertex and behind the temples, which is the principal character on which the subgenus was founded.

*Apion dives*, sp. n.

♂. Very close to *scotti*, described above, but the rostrum more distinctly punctured, the pronotal constrictions distinct, the elytra more highly convex and the aedeagus sharply distinct.

*Head* as long as wide, the eyes moderately prominent, the frons with two short but distinct parallel sulci, coarsely microreticulate, punctate, the punctures more distinct than in *scotti*. *Rostrum* a little shorter than head and pronotum together, reticulate, moderately densely punctured, apically slightly narrower than at antennal insertion, thence to the base parallel-sided, weakly curved; basilateral sulci quite obsolete, the space between the antennal insertion and the anterior margin of the eye greater than the diameter of the eye. *Antennae* piceous, scape barely longer than the basal segment of the funicle, which is about two-and-a-half times as long as wide, second and third segments subequal, each a little shorter than the first, 4-7 progressively shorter and broader but 7th at least one-and-a-half times longer than

wide. *Pronotum* nearly cylindrical, about as long as wide, subbasal and subapical constrictions moderately strong; dorsal outline moderately convex from apex to shortly before middle, thence to base flat; shagrinata, densely but shallowly punctured, the punctures large. The subbasal constriction is carried from side to side right across the dorsum. *Scutellum* short oval. *Elytra* ovate, humeral callus strongly developed, sides more strongly rounded than in *scotti*, dorsal outline much more convex, almost as in *benignum*, highest before the middle; striae well impressed, the catenate punctures distinct; 1st and 2nd not much more strongly impressed apically, where they unite with 9th; intervals weakly convex dorsally, flat laterally, more than three times wider than the striae, finely shagrinata. *Legs* shorter than in *scotti* but slender; hind femora not reaching apex of elytra; basal tarsal segment long, almost as long as the two following together.

*Length*, 2.0 mm.

ABYSSINIA: Mt. Zukwala, forest near top, circa 9,665 ft., 25. x. 1926, 1 ♂.

This species is closer to *constrictum* than to *scotti* in the lateral view contours, but is larger, duller and less shining, the apically narrowed rostrum, rather more prominent eyes and distinct aedeagus serve to distinguish it from the compared species.

*Apion iris*, sp. n.

♂♀. Black, shining, with a very short, very fine pubescence which is uniseriate on the elytral interstriae.

*Head* a little wider than long, eyes not prominent, flatly rounded; frons narrower than the base of the rostrum, flat, microreticulate; temples very short, one-fifth of the diameter of the eye, rugose or coarsely punctured, the vertex seen in lateral view slightly constricted behind. *Rostrum* of male shorter than head and pronotum together, curved cylindrical; the basi-lateral sulci distinct, fading out at the antennal insertion, the space equal to the diameter of the eye; surface distinctly at the base, apically obsolete, reticulate, obsolete and sparsely punctate; of female longer than head and pronotum together, finer than in the male, basally obsolete reticulate, apically smooth and shining, finely, obsolete and sparsely punctate; basilateral sulcus as in male. *Antennae* testaceous, inserted in the male at rather more than one-



third, in the female at one-quarter from the base, slender ; scape twice as long as the basal segment of the funicle, which is a little longer than the second segment and nearly two-and-a-half times as long as wide, 3-7 progressively shorter and broader, 7th one-and-a-half times as long as wide. *Pronotum* wider than long, widest at the base, apex one-third narrower than the base, subapical constriction strongly marked, surface obsoletely reticulate, very finely and rather sparingly punctured ; dorsal outline weakly convex ; a very shallow median dorsal subbasal fovea. *Scutellum* nearly square, very small, obsoletely depressed in the middle. *Elytra* ovate, dorsal outline moderately convex, highest before the middle : striae strongly impressed, the catenate punctures distinct, 1st and 2nd posteriorly very deeply impressed and uniting with 9th ; interstriae weakly convex, obsoletely but more distinctly reticulate than on pronotum, very finely and obsoletely setiferous punctate ; sutural apices rounded in the male, produced rectangular in the female ; humeral callus well developed. *Venter* : 5th abdominal segment of the male closely punctured in the apical angles only, of female with a subapical elongate shallow fovea, sides obscurely punctured. *Legs* moderately long and slender, hind femora not reaching apex of elytra ; basal segment of hind tarsus not very long, underside in male concave, the middle of the ventral apex produced into a short stout tooth ; claws distinctly toothed at the base.

*Length*, 1.90-2.19 mm.

ABYSSINIA : Mulu, above Muger Valley, circa 8,000 ft., 18-23. xii. 1926, 2 ♂, and "from vegetation near streams," 1 ♀ ; Mt. Zukwala, in crater, circa 9,000 ft., 26. x. 1926, 1 ♂ (*Piezotrachelus particeps* Wagner, Hustache det.).

The *type* and *allotype* from Mulu.

This species does not belong to *Piezotrachelus*. It has some resemblance to *particeps* in form but the difference in the length of the rostrum is marked. The weak transverse impression on the vertex of the head suggests the weakly characterised subgenus *Pseudopiezotrachelus*, and the species evidently comes near *probum* and *scotti*. Compared with *benignum* the pronotum is more finely punctured and Faust says that *benignum* is more finely punctured than *probum* ; the elytra are also more shining than in *benignum*, not less so as is described for *probum*.

*Apion muluanum*, sp. n.

♂♀. Bluish-black, dull, microreticulate, distinctly pubescent, the hairs white, short and fine, irregularly biseriate on the elytral interstriae.

*Head* wider than long, the eyes moderately prominent; frons nearly as wide as the base of the rostrum, flat, strongly microreticulate, sparingly and finely punctured; temples very short, one-fifth of the diameter of the eye, rugose-punctate. *Rostrum* of male distinctly, of female barely shorter than head and pronotum together, microreticulate at base, smooth and shining from the antennal insertion to the apex, closely and finely punctured, rather weakly curved, apically gradually narrowed but still moderately stout; basilateral sulci distinctly impressed, reaching to the antennal insertion, this space equal to the diameter of the eye plus the temple; a fringe of very short hairs around the eye. *Antennae* piceous, slender, inserted at one-third from the base of the rostrum; scape elongate, twice as long as the basal segment of the funicle which is ovoid, two-and-a-half times as long as at its widest point, second segment one-third shorter than the first, 3-7 progressively decreasing in length but increasing in width. *Pronotum* as long as wide, widest at the base, one-third narrower at the apex than at the base, subapical constriction not very marked; dorsal outline very weakly convex, nearly flat; a median longitudinal subbasal stria sharply impressed in front of the scutellum; surface distinctly and closely but moderately finely punctured, each puncture carrying a short white hair. *Scutellum* short, parallel-sided, twice as long as wide, very shallowly channeled from base to apex. *Elytra* ovate, sides gently rounded, dorsal outline not very highly convex, highest at middle; humeral callus not very marked; striae strongly impressed, the edges sharp, the catenate punctures closely spaced and distinct, 1st and 2nd deeper at the apex, uniting with 9th; intervals flat, strongly microreticulate, transversely slightly rugose, very finely and irregularly biseriate punctate, about three times as wide as the striae; sutural apices in both sexes rather abruptly rounded. *Venter*: 1st and 2nd fused abdominal segments sharply punctured, not very dense except on the intermetacoxal projection, which is transversely rugose; 5th segment of female non-foveate.

*Legs* rather short and slender, hind femora not nearly reaching apex of elytra.

*Length*, 2.19–2.27 mm.

ABYSSINIA : Mulu, above Muger Valley, circa 8,000 ft., 18–23. xii. 1926, 5 ♂, 2 ♀.

This species belongs close to the preceding, having a similar transverse depression on the vertex which brings it closer to *probum* by the dullness, but the thoracic punctures, though stronger and denser, are still finer than in *benignum* with which Faust compared *probum*.

*Apion muluanum*, forma *zukunftæ*, nov.

Very close to the type form but distinctly smaller. the fused 1st and 2nd ventral abdominal segments only obsoletely punctured. The principal distinction lies in the ædeagus, which is more evenly curved in lateral view, the flattened apical portion much shorter, not weakly laterally constricted, the apex not so distinctly upturned.

*Length*, 1.93 mm.

ABYSSINIA : Mt. Zukwala, circa 9,000 ft., 21–25. x. 1926, 1 ♂.

This unique specimen may only be due to individual variation or aberration correlated with the small size. but the difference in the ædeagus deserves to be mentioned.

*Apion fortirostre* Wagner, 1908.

*Apion ? beguini* Hustache ex parte, op. cit. p. 501, footnote (nec Wagner).

A unique male which agrees exactly with a male from NATAL (Durban), identified by Wagner in the British Museum ; there are also two females in the British Museum collection labelled " ABYSSINIA " without further information, determined by Wagner, but I am not aware of any published records for the species in this area.

ABYSSINIA : Mt. Chillalo, forest, circa 8,500 ft., 24. xi. 1926, 1 ♂.

*Apion discors*, sp. n.

*Apion ? beguini* Hustache ex parte, loc. cit. (non Wagner).

♂♀. Black, with a vestiture of white hair-scales which are triseriate on the elytral interstriae and grouped as a small tuft at the base of the third elytral interstria ; a thick coat of scales on the mesosternal episterns ; femora somewhat inflated ; tarsal claws elongate, the basal tooth strongly developed, nearly as long as the main ramus.

*Head* distinctly wider than long, eyes not at all prominent, flatly convex; temples very short, linear; frons half as wide as the base of the rostrum with two longitudinal rows of scale-bearing punctures, the vertex distinctly punctured, eyes with a surrounding fringe of scales. *Rostrum* of male distinctly shorter than the head and pronotum together, stout, straight or very weakly curved, moderately shining, strongly longitudinally rugose punctured, the hairs short and adpressed; of female distinctly longer than the head and pronotum together, a little finer than in the male, similarly straight or only very weakly curved, strongly longitudinally rugose-punctate; in both sexes very slightly laterally produced above the antennal insertion and ventrally with two parallel longitudinal furrows from antennal insertion to apex; basilateral sulci more distinct in the female than in the male. *Antennæ* piceous, short and stout in the male, long and slender in the female, inserted at about one-quarter from the base of the rostrum; in the male scape nearly as long as the three basal segments of the funicle taken together, in the female as long as the four basal funicular segments taken together; the basal segment of the funicle in the male at most one-and-a-half times as long as wide, in the female three times as long as wide; segments 3-7 of the male as long as wide, of the female progressively shorter, 7th as long as wide. *Pronotum* wider than long, the sides strongly rounded, widest at middle, the base bisinuate; dorsal outline moderately convex; strongly microreticulate, closely and rather strongly but shallowly punctured, a sharply impressed longitudinal stria just in front of the scutellum; subapical constriction not very distinct; clothed dorsally with longish white hairs which laterally become longer and broader and more scale-like; anterior edge of prosternum with porrect scales. *Scutellum* short oval or triangular, obsoletely impressed in the middle. *Elytra* ovate, sides very weakly rounded, dorsal outline not at all highly convex; humeral callus strongly developed; the striæ deeply and sharply impressed, the catenate punctures strong and evenly spaced, each space between the punctures with a short hair-scale; interstriæ flat, rather shining, with three rows of hair-scales except the sutural, which is unilinear on the disc; apices in the female produced, sharply rounded, in the male normally widely

rounded. *Venter*: metasternum evenly and strongly punctured, not very densely clothed with scales; mesosternal episterns densely scaled. *Legs* long but not very slender, the femora rather inflated, hind femora just reaching the apex of the elytra; mid- and hind-tibiæ without interno-apical spur in the male; femora and tibiæ evenly clothed with hair-scales, apices of tibiæ rather flattened and clothed with fine golden hairs externally, sooty internally.

*Length*, 2.19-2.63 mm.

ABYSSINIA: Mulu, above Muger Valley, circa 8,000 ft., 18-23. xii. 1926, 2 ♂, 2 ♀.

This species comes close to *kwaiense* Hartm. and *pauli* Hartm. by the great development of the basal tooth of the tarsal claws. It differs from *kwaiense* by the more distinctly scale form of the hairs, the greater disparity in length of the rostrum between the sexes, the finer and a little less dense punctuation of the thorax. From *pauli* it differs by the colour of the clothing, the shorter and stouter rostrum of the male, the distinct pronotal microreticulation of the female. The ædeagus is narrower and less curved than that of *pauli*.

*Apion concors*, sp. n.

*Apion* ? *beguini* Hustache ex parte, loc. cit. (non Wagner).

♀. Black, with a clothing of white hair-scales which are biseriate on the elytral interstriae and grouped at the base of the third interstria as a small tuft, the mesosternal episterns thickly clothed; femora slightly inflated; tarsal claws short, bluntly toothed at the base.

*Head* distinctly wider than long, eyes rather prominent; temples very short; frons as wide as the base of the rostrum, with two longitudinal rows of scale-bearing punctures, the vertex distinctly punctured, eyes with a surrounding fringe of scales. *Rostrum* longer than the head and pronotum together, nearly straight, cylindrical, basally distinctly, apically more obsolete and finely longitudinally rugose-punctate, ventrally with parallel punctured furrows from antennal insertion to near the apex; basilateral sulci distinct, the space a little more than the diameter of an eye. *Antennæ* flavo-piceous, elongate, slender, inserted at about one-quarter from the base of the rostrum, scape very long, as long as the four basal segments of the funicle taken together, basal segment of the funicle as long as the

three following taken together, 2nd to 7th progressively shorter and broader, 7th square. *Pronotum* distinctly microreticulate, as long as wide, widest at the middle, sides sinuate, the posterior angles rather produced, both subbasal and subapical constrictions present, shallow, base bisinuate; dorsal outline weakly convex; fairly densely but shallowly punctured, each puncture giving rise to a hair-scale; a shallow median longitudinal antescutellar stria or fovea. *Scutellum* narrowly triangular, short, flat. *Elytra* oval, sides weakly rounded, widest at middle, dorsal outline not very strongly convex; humeral callus strongly developed; striae well but not sharply impressed, the catenate punctures very distinct, the intervals between the punctures each giving rise to a hair-scale; interstriae convex, rather shining with two rows of hair-scales, including the sutural interstria, on the disc; sutural apices normally rounded, not produced. *Venter*: metasternum evenly and sharply punctured, each puncture bearing a scale, the punctures closer near the posterior angles so that the scales there are denser; the mesosternal episterns thickly scaled; fused 1st and 2nd abdominal segments evenly punctured, finely reticulate, 5th strongly reticulate and evenly punctured. *Legs* testaceo-piceous, moderately long and slender, femora slightly inflated, those of hind legs not reaching elytral apices. Claws short, basal tooth blunt but distinct.

*Length*, 2.63 mm.

ABYSSINIA: Debra Libanos, circa 8,000 ft., 2. i. 1927, 1 ♀.

This species is superficially remarkably similar to *discors* described above, the scaling and sculpture being very nearly the same but the short tarsal claws, the wider frons, the convex interstriae and the strongly but not sharply impressed striae distinguish the species adequately. It comes very close to *tanganum* Hartm., of which I have only seen males, but has the clothing more hair-like, less scale-like than in that species. It could not be *beguini* as supposed by Hustache, since Wagner expressly states in his description that that species has weakly convex interstriae with "einer Reihe härcchen-tragender Pünktchen."

*Apion spadiceum* Wagner, 1908.

*Apion ? beguini* Hustache ex parte, loc. cit. (non. Wagner)

A single female, undoubtedly belonging to this species, which does not appear to have been previously recorded

from Abyssinia but has been mentioned from Eritrea (Wagner, Stett. Ent. Zeit., 1908, p. 66).

ABYSSINIA : Mt. Chillálo, forest, circa 9,000 ft.. 12. xi. 1926, 1 ♀.

*Apion tagagnei*, sp. n.

*Apion* ? *tellinii* Hustache, loc. cit. (non Wagner).

♂♀. Black, sparingly clothed with golden and whitish hairs and scales, scutellum elongate triangular.

*Head* wider than long, eyes not at all prominent, flatly rounded ; frons narrower than base of rostrum, finely reticulate, sparingly punctured ; temples very short, linear ; eyes with a fringe of white setiform scales which are much longer and porrect beneath. *Rostrum* of male shorter, of female as long as head and pronotum together, weakly curved, stout, cylindrical, with longitudinal rows of punctures set in impressed lines, particularly laterally and ventrally, the punctures giving rise to porrect scales ; basilateral sulci distinct, fading out at antennal insertion, the space between this and the eye equal to the diameter of the eye ; from base to antennal insertion microreticulate, then to apex smooth and shining. *Antennæ* rufo-piceous, elongate, inserted at one-quarter from the base of the rostrum ; scape long, two-and-a-half times as long as the basal segment of the funicle which is twice as long as wide, 2-7 progressively shorter, 7th transverse. *Pronotum* wider than long, widest about the middle, sides moderately rounded, dorsal outline moderately convex ; subapical constriction very shallow ; sparsely and shallowly punctured, the punctures fairly large and each giving rise to a setiform scale which becomes broader, more scale-like laterally ; surface microreticulate. *Scutellum* elongate, narrowly triangular with two short acute basal tubercles and the apex projecting in a very short point ; surface reticulate. *Elytra* obovate, broad at the base, broader than base of the pronotum, humeral callus very distinct, dorsal outline moderately convex ; striæ well impressed, catenate punctures sharply impressed, the interval between each puncture giving rise to a white setiform scale. Interstriæ convex, transversely finely rugose, rather shining, about one-and-a-half times as wide as the striæ, sutural, 3rd, 5th and 7th intervals bearing a single row, 2nd, 4th, 6th, 8th and 9th intervals bearing a double row of fine golden setiform scales, which on the 8th to outermost intervals become broader and whiter ; sutural apices

of male widely, of female abruptly rounded. *Venter* : fore coxæ of male thickly, of female sparingly clothed with white scales in front ; metasternum with a few large scale-bearing punctures ; 1st and 2nd abdominal segments finely punctured with finer scales than metasternum ; 5th segment of female very broadly triangular, very short, finely punctured, non-foveate. *Legs* pitchy, short and not very slender, femora slightly inflated, last pair not nearly reaching apex of elytra : mid- and hind-tibiæ of male bearing a short black termino-ventral spur ; claws short and thick, finely toothed at base.

*Length*, 2.0–2.19 mm.

ABYSSINIA : Dobra Libanos, circa 8,000 ft., 2. i. 1927, 2 ♂. 2 ♀ ; Mulu, above Muger Valley, circa 8,000 ft., 18–23. xii. 1927, 1 ♀.

This little species does not agree with Wagner's description of *tellinii*, which is said to be very near *tanganum* except in certain characters such as the smaller head, less prominent eyes, longer and more slender antennæ and longer legs. This leaves it to be inferred that the scutellum of *tellinii* is simply oval as it is in *tanganum* since Wagner would hardly overlook so marked a distinction. *A. tagagnei* certainly belongs to the "*tanganum-group*," which is a rather complex arrangement of species with short claws or long claws, short oval scutellum or elongate-triangular scutellum, etc. It is apparently closest to *armipes* Wagn., both in size and structure, the rostrum is longer and thinner, eyes a little less prominent, frons more finely and sparingly punctured and the elytra rather shorter but broader in proportion. It is named after Dr. Scott's personal servant.

*Apion gracilipenne* Wagner, 1908.

The series doubtfully ascribed to this species by Hustache seems to me quite correctly identified according to the description of a unique female by Wagner, although the size is much larger than that given (2.3 : 1.9 mm.). The male differs from the female in the shorter, stouter rostrum, which is finely and obsoletely reticulate and finely but not so sparingly punctured as in the female. The elytral interstriae are rather shining in the series before me, hardly "etwas runzlig chagriniert." There is no visible sexual dimorphism in the four hind tibiæ or basal



segment of the four hind tarsi. The sutural apices of the elytra of the male are widely rounded, of the female produced, rectangular. The 5th abdominal ventral segment of the female is non-foveate, finely and closely punctured, microreticulate, each puncture giving rise to a fine, short greyish hair.

**ABYSSINIA** : Jem-Jem Forest, circa 8,000 ft., 23. ix. 1926, 1 ♂; Serpent Lake, Wouramboulchi, circa 9,000 ft., 5. x. 1926, 1 ♂, 1 ♀; Mt. Zukwala, circa 9,000 ft., 26. x. 1926, 1 ♀; Mt. Chillálo, circa 10,000 ft., 17-19. xi. 1926, 1 ♀; Mulu, above Muger Valley, circa 8,000 ft., 18-23. xii. 1926, 1 ♀.

*Apion nugax*, sp. n.

♂♀. Black, elongate, clothed dorsally with smoky-golden hairs except for a very incomplete transverse fascia of white hairs behind the middle; venter and sides clothed with greyish-white hairs.

*Head* a little wider than long, eyes moderately prominent, temples short, about one-third of the diameter of the eye; frons as broad as the base of the rostrum, closely and strongly punctured, almost rugose, reticulate. *Rostrum* of male distinctly, of female little shorter than head and pronotum together, distinctly curved, cylindrical, very obsoletely but closely punctured, in the male with distinct porrect hairs, in the female with very short very fine hairs, reticulate; basilateral sulci quite obsolete, the space between the antennal insertion and the eye short, about half the diameter of the eye. *Antennæ* rufo-piceous, long and slender, the scape as long as the three basal segments of the funicle taken together; basal segment barely longer than the second, about two-and-a-half times as long as wide, 3-7 progressively shorter, 7th globular. *Pronotum* a little wider than long, widest at the base where the sides are a little produced, strongly microreticulate, closely and fairly strongly but shallowly punctured, with a sharply impressed median subbasal fovea; dorsal outline flat; very shallow subbasal and subapical constrictions. *Scutellum* very small oval. *Elytra* elongate-oval, sides very weakly rounded, humeral callus distinct; widest at apical third, posteriorly sharply attenuate-oval; dorsal outline very low convex; striæ sharply and strongly impressed, catenate punctures deep, intervals between

punctures each bearing a smoky hair; interstriae flat, hardly wider, than the striae, somewhat rugosely shagreened; on the disc from suture to the 8th interstria with smoky-golden hairs, grouped as a small tuft at the base of the third interstria, behind the middle extending to the 5th interstria a narrow transverse band of whitish hairs; 9th and external interstriae with whitish-grey hairs that extend towards the suture at the apex and occur on the sides of the pronotum and the venter. *Venter*: metasternum distinctly but, finely punctured, the fused 1st and 2nd abdominal segments a little more coarsely so; 5th segment of the female flat, non-foveate. *Legs* piceous, rather short but slender, claws apparently untoothed at the base; no visible sexual dimorphism; hind femora barely reaching past the base of the 5th ventral segment.

*Length*, 2.0–2.27 mm.

ABYSSINIA: Mt. Chillálo, forest, circa 8,500 ft., 24. xi. 1926, 1 ♂, 1 ♀.

This little species seems rather isolated from all others hitherto described, but the colour-pattern of the hairs suggests the much larger *oxyrhynchum* Wagn.

*Apion jenjemense*, sp. n.

♂♀. Black, obovate, rather strongly convex, elytra very much widened in apical third, striae very strongly impressed, with a clothing of silvery-golden hairs irregularly distributed on the interstriae.

*Head* distinctly broader than long, eyes very prominent, facets large; frons as wide as the base of the rostrum, strongly punctured, rugose and strongly microreticulate, temples extremely short, eyes with a fringe of white hair-scales. *Rostrum* barely shorter than head and pronotum together, slender, distinctly but not very strongly curved, broad at the base, slightly angularly dilated at the antennal insertion, thence very slightly narrowed to the apex, reticulate at the base, smooth and shining in the apical half, finely and sparsely punctured; basilateral sulci very obsolete; the space between the eye and the antennal insertion only two-thirds the diameter of the eye. *Antennae* testaceo-piceous, short and stout; inserted at about one-fifth from the base of the rostrum; scape twice as long as basal segment of the funicle, which is one-third longer than wide, globular, 2–7 progressively shorter,

7th transverse. *Pronotum* distinctly wider than long, widest just behind the middle, sides strongly rounded, subapical constriction rather strong, base distinctly bisinuate; surface strongly shagreened, coarsely but shallowly and closely punctured except in the median line, which is occupied by a well impressed striiform fovea from middle to base, clothing of rather long curved hairs; dorsal outline very weakly convex. *Scutellum* narrow, about twice as long as wide, more or less distinctly impressed in the middle at base. *Elytra* obovate, wider at base than base of pronotum, humeral callus moderately distinct, sides rounded, widest at apical third, thence strongly rounded; dorsal convexity not very high, highest just behind middle; striae very strongly and deeply impressed, the catenulate punctures distinct, intervals between these punctures as wide as the punctures, each bearing a hair; interstriae very convex, shining, obsoletely rugose with irregularly placed but fairly dense hairs. *Venter*: metasternum rather shining with scattered punctures, as are the fused 1st and 2nd abdominal segments, the punctures here larger, their concavities reticulate. *Legs* short and rather stout, tarsi short, two basal segments of the four posterior legs subequal, about as long as wide at the apex. Sexual dimorphism very little marked, the male rostrum is a very little shorter and stouter than that of the female, the only conclusive external character being the form of the 5th abdominal venter.

*Length*, 1.91–2.08 mm.

ABYSSINIA: Jem-Jem Forest, "damp shady places," 8,000–9,000 ft., 21–22. ix. 1926, 2 ♂, 1 ♀.

This little species is rather reminiscent of the European *A. pisi* Fabr. in form, but it is very isolated among Ethiopian species and is, indeed, unlike any other known to me.

*Apion vitula*, sp. n.

*Apion subnitidum* Hustache, loc. cit. (non Wagner).

♂♀. Black or piceous, obovate, rather depressed, furnished with a deciduous white pubescence of longish white hairs.

*Head* half again as wide as long, eyes moderately prominent, frons as wide as the base of the rostrum, the vertex sharply and fairly strongly punctured, obscurely rugose, somewhat finely microreticulate; temples very short.

*Rostrum* of male distinctly, of female not very distinctly shorter than the head and pronotum together, weakly curved, parallel-sided to the antennal insertion then very slightly narrowed to apex, the fining-down not easily recognised but definite; distinctly but finely and sharply punctured, reticulate in the male, shining in the female; basilateral sulci not present. *Antennæ* flavo-piceous or piceous, fairly long but not slender, inserted at one-third from base of rostrum; scape twice as long as the basal segment of the funicle, which is about one-and-a-half times as long as wide, rather globular, 2-7 progressively shorter, 7th nearly transverse. *Pronotum* evidently wider than long, widest at the middle, sides moderately strongly rounded, constrictions obsolete, dorsal outline nearly flat; surface shining or more or less reticulate, strongly and densely but shallowly punctured; a median dorsal lightly impressed stria just in front of the scutellum of variable length and in some specimens nearly obsolete. *Scutellum* very small, round, flat or obsoletely impressed in the middle. *Elytra* ovate, sides weakly rounded, widest at the apical third, not at all highly convex, rather depressed on the disc, humeral callus well developed, the base of the elytra distinctly wider than the base of the pronotum; striae fine but sharply impressed, the punctures not distinct; interstriae flat, three times at least as wide as the striae, stria 1 alone uniting with 9th apically. *Venter*: mesosternal episterns fairly densely clothed with fine scales; metasternum and fused 1st and 2nd abdominal segments evenly and shallowly punctured, the punctures large. *Legs* rufo-piceous, short, fairly slender, hind femora not reaching the apex of the elytra; claws long, finely toothed at base; four posterior tibiae of the male armed internally at the apex with a strong piceous spine.

*Length*, 1.54-1.87 mm.

ABYSSINIA: near Addis Alam, circa 8,000 ft., 18-19. ix. 1926, 3 ♂, 6 ♀; Mulu, above Muger Valley, circa 8,000 ft., 18-23. xii. 1926, 1 ♂.

This little species was clearly misidentified as *subnitidum* Wagner, by Hustache, differing from the description of that species in a number of particulars although evidently related thereto. It is remarkable for the deciduous nature of the pubescence, which is more easily rubbed off than in most other species of the genus.

*Apion* spp.

Eight specimens, all females, representing a further seven species, remain unidentified as follows :—

- sp.* 1. Mt. Zukwala, circa 9,000 ft., "beaten from trees near lake shore," 22. x. 1926.
- sp.* 2. Between Lake Zwai and Makki River, 5,500–6,000 ft., 23–24. xi. 1926; Mulu, above Muger Valley, circa 8,000 ft., 18–23. xii. 1926.
- sp.* 3. Marsh near Lake Hora Abjata, circa 5,000 ft., 18. xi. 1926.
- sp.* 4. Mulu, above Muger Valley, circa 8,000 ft., "from vegetation near streams," 18–23. xii. 1926.
- sp.* 5. Mt. Chillálo, forest, circa 8,500 ft., 24. xi. 1926.
- sp.* 6. Marsh near Lake Hora Abjata, circa 5,000 ft., 18. xi. 1926.
- sp.* 7. Mulu, above Muger Valley, circa 8,000 ft., 18–23. xii. 1926

*Apion (Aspidupion) radiolus* Kirby, 1808.

ABYSSINIA : Mt. Zukwala, circa 9,000 ft., "beaten from trees near lake shore," 22. x. 1926, 1 specimen, and from highest point of crater-rim, 9,665 ft., 23. x. 1926, 1 specimen.

This species was recorded from Eritrea by Wagner (Ann. Soc. ent. Belg. liii. 1909. p. 205).

*Apion (Ceratapion) mundum*, *sp. n.*

♀. Black, elongate, elytra almost parallel-sided, clothing of fine greyish hairs.

*Head* a little wider than long, the eyes not very prominent, flatly rounded; frons as wide as the base of the rostrum, strongly microreticulate, finely and very indistinctly punctured; temples moderately long, about two-thirds of the diameter of the eye, reticulate. *Rostrum* slightly longer than the head and pronotum together, distinctly curved, moderately slender, slightly widened at antennal insertion, nearly cylindrical, reticulate except at the apex, which is smooth and shining, very finely punctured; basilateral sulcus quite obsolete, the space between eye and antennal insertion the same length as the diameter of the eye. *Antennæ* stout and long, clothed with whitish-brown hairs, inserted at one-sixth from the base of the rostrum, at least as long as the rostrum; apical segments.

of funicle not broader than the basal segments, scape twice as long as the basal segment of the funicle, which is twice as long as wide, second segment two-thirds the length of the first, 3-7 as long as wide, club elongate-oval. *Pronotum* a little longer than wide, nearly cylindrical, apex as wide as the base, dorsal outline nearly flat, surface strongly microreticulate, strongly punctured, the punctures separated from each other by about their diameter; a sharply impressed elongate fovea in the mid-dorsal line in front of the scutellum. *Scutellum* very small, round and flat. *Elytra* elongate, twice as long as wide, sides parallel or so very weakly rounded as to appear so; dorsal outline flat or nearly so at the disc; humeral callus not very strongly developed; striae sharply but not very deeply impressed, the catenate punctures distinct; striae 1 and 2 uniting with 9 at apex; interstriae one-and-a-half to two times as wide as the striae. flat, transversely finely rugulose, each with a single row of fine hairs from base to apex except the third at the base, where a small tuft is set and also the sutural on the disc is irregularly, posteriorly regularly bilinear. *Venter*: metasternum and fused 1st and 2nd abdominal segments with scattered strong but shallow punctures; 5th segment flat, obsoletely reticulate and obsoletely punctured. *Legs* short, hind femora barely extending past the apex of the 2nd abdominal segment; claws short, simple at base.

*Length*, 2.41 mm.

ABYSSINIA: Mt. Chillálo, forest, circa 9,000 ft., 14. xi. 1926, 1 ♀.

This species is extremely close to a unique male so far undetermined from the Yemen (British Museum Expedition, 1937-8), but is distinct by the clothing of hairs, not flattened scales. It is also close to the European *penetrans* Germ., but is distinguished from that species by the much finer punctuation of the head, which does not become at all rugose between the eyes, the wider spacing of the pronotal punctures, the finer pronotal fovea, the rugose, not shining elytral interstriae and by the unilinear distribution of the hairs on the interstriae. It does not agree with any of the species listed by Wagner in his key to the species related to *bæhmi*, (Bull. Soc. ent. Égypte, 1911, pp. 52-56), mostly found in Egypt or the Eastern Mediterranean area.

*Apion (Conapion) cyladooides* Hartm.

"ABYSSINIA," without further data, 1 ♂ (*A. Raffray*).

*Apiomorphus (Apiomorphilus) corvinus* Voss, 1931.

ABYSSINIA: Jem-Jem Forest, 8,000-9,000 ft., ix.-x. 1926, 3 specimens; Mt. Chillálo, forest, circa 8,500 ft., 24. xi. 1926, 4 specimens.

This is the type series of specimens that served Voss for the description.

LXV.—*A new Genus, Bedfordia, and other records of Dragon-flies from the Marquesas Islands\**. By EDWARD PHILPOT MUMFORD, M.A., M.Sc., F.R.E.S., Stanford University, California, U.S.A.

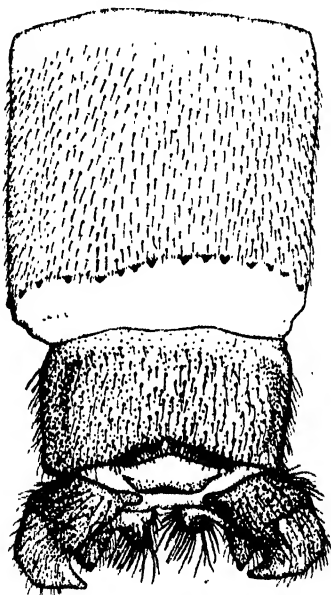
INTRODUCTION.

IN earlier publications on the collections made in the isolated Marquesas Islands, in the South Central Pacific, by the writer and his associates on the Pacific Entomological Survey, Professor J. G. Needham (1932 and 1933*a*), of the Department of Entomology, Cornell University, identified and described two species of *Hemicordulia*. An old genus, according to Lieutenant-Colonel F. C. Fraser (1927), it may well have originated in the ancient submerged Western Pacific continent. In the Marquesas it is represented by two species. One of these, *mumfordi* Needham, was taken only in the cloud zone of Mt. Temetiu, Hivaoa. The other, *assimilis* Hagen, hitherto known only

\* *Studies on Faunal Distribution*, No. 2.—These studies of faunal distribution, initiated by Mr. E. P. Mumford at Oxford, under my general direction, at the expense of funds received through the Higher Studies Fund at Oxford, the Royal Society, the British Museum (Natural History), and the British Association for the Advancement of Science, have, since the war, received further support from the Carnegie Corporation of New York, the National Academy of Sciences, the Society of Sigma Xi, the American Association for the Advancement of Science, the American Philosophical Society, and the May Esther Bedford Fund, Inc. Acknowledgement is here made, on behalf of Mr. Mumford and myself, to all of these organizations, and especially to the Officers and Trustees of Stanford University, where the work is now being carried on, as well as to the Hawaiian institutions ('Nature,' vol. cxxx, No. 3291, pp. 797-798 and 803, Nov. 26, 1932), which enabled Mr. Mumford to visit the Marquesas and Tahiti. A note on the Pacific Entomological Survey, of which Mr. Mumford was Director, was published in 'Nature,' vol. cxli, p. 196, Jan. 1938. See also Mumford and Adamson (1933), and Mumford (1936 and 1940, *a* and *b*). The Pacific Entomological Survey publications were concluded in 1939.—G. D. HALE CARPENTER, Hope Professor of Zoology (Entomology), University Museum, Oxford.

from the supposedly continental Solomon Islands, was taken in the same locality on Hivaoa and in the upper intermediate zone at Vaitupaahei, Tahuata. These adjacent islands of Hivaoa and Tahuata also share the same form of warbler and fly-catcher, perhaps adding confirmation to Burrington Baker's (1941) suggestion that the two islands be regarded as constituting a single faunal unit.

Fig. 1.



Anal appendages of *Bedfordia hale-carpenteri*, sp. n., dorsal view.

In a further paper on the Marquesan collections, Needham (1933 *b*) also described the species *demorsum* of the Indo-Australian-Ethiopian genus *Pseudagrion* \*. This species was taken in the upper intermediate and cloud zones of Hivaoa and Nukuhiva. Another species, *Cænagrion interruptum* Needham (1932), for which the new genus *Bedfordia* is here erected, is at present known only from the collections from Uapou and Tahuata. As

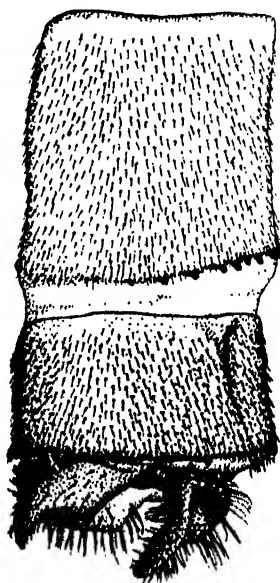
\* About half the species of *Pseudagrion* come from Africa, the others are all Indo-Australian in origin.—F. C. F., D. E. K.



Dr. Erich Schmidt points out (*in litt.* Sept. 17, 1936, to Professor Needham), the name *interruptum* is preoccupied. The new name *hale-carpenteri* is therefore here proposed for *interruptum*.

In addition, there is here recorded from the Marquesas for the first time *Hemicordulia assimilis oceanica* Selys and *Rhyothemis* sp., larva only, collected by the writer and his associates on Nukuhiva. The imagos of *oceanica*

Fig. 2.



Anal appendages of *Bedfordia hale-carpenteri*, sp. n., seen in profile from the left side.

were taken from three thousand feet upwards, and the *Rhyothemis* nymphs in Vaihakameama Pool at two thousand six hundred feet. *Oceanica* had been described from the Society group, the nearest high islands, in 1871, but it is now known to range clear across the Pacific from New Britain to the Marquesas. *Rhyothemis*, on the other hand, had not been recorded previously east of Samoa, where it is represented by the East Indian *regia exul* Ris,

and *chalcoptilon* (Brauer). Professor P. A. Buxton (Fraser, 1927), however, raises the question as to whether the attribution to Samoa of the latter species may not rest upon wrongly labelled material.

Also published here for the first time are field data for *Pantala flavescens* (Fabr.), *Tholymis tillarga* (Fabr.), and *Ischnura aurora* Brauer. Of these, the circumtropical *flavescens* is represented from the Marquesas in the Selys Collections at Brussels by a single male; *tillarga*, a species ranging from the Old World tropics into islands far removed from continental masses, is represented from the Marquesas by a single male in the Museum at Hamburg; and the widely distributed wind-carried *aurora*, apparently recorded from the Marquesas for the first time by Cheesman (1927), is represented in the collections at the British Museum. Specimens of *Diplacodes bipunctata* (Brauer) also widely distributed and wind-carried, were taken in the Marquesas for identification, but the Survey field data for this particular species are not at present at hand. For this species a single male from the Marquesas has also been recorded at the Museum at Hamburg.

In the Marquesas the dragonfly is commonly known as *pinao* (cf. the Tahitian *piao* and the Hawaiian *pinao*).

The new genus, named *Bedfordia*, is dedicated to the May Esther Bedford Fund, Inc., and the donors thereof, in appreciation of their continued interest in the work now being carried on by the writer at Stanford University. The species *hale-carpenteri*, formerly known as *interruptum*, is here named after Professor G. D. Hale Carpenter, without whose unfailing help and encouragement this study of faunal distribution could never have been undertaken. Acknowledgement is also due to Professor Needham for the re-examination of the paratypes of *Bedfordia hale-carpenteri* and the identification of the material, to Lieutenant-Colonel Fraser for preparing the description of the new genus which I name *Bedfordia*, to Mr. M. J. Westfall, Jr., for preparing the drawings, and to Mr. D. E. Kimmins and Dr. Erich Schmidt.

With the exception of certain duplicates which belong to Professor Needham, the specimens on which the new records are based have been entrusted for safe keeping to the Bernice P. Bishop Museum in Hawaii.

## Order ODONATA.

## Suborder ZYGOPTERA.

## Family Cœnagrillidæ.

## BEDFORDIA, gen. nov.

Wings petiolated to a little proximal of Ac, which latter is situated midway between the two antenodals; arc very slightly distal to the level of the distal antenodal, especially in hindwing; quadrilateral acute distally, its costal side less than half the length of posterior side in forewing, and more than half the length of posterior side in hindwing; three cells between quadrilateral and nervure descending from subnode; *Miii* arising slightly distal to level of node; *Mii* arising 5 to 6 cells distal to node and *Mia* 3 cells distal to the origin of latter. (In the original description of *Cœnagrion interruptum* the nervure *Mii* is stated to arise near the sixth antenodal, but this is an obvious error for postnodal); pterostigma diamond shaped, of the same colour and approximately the same shape and size in all wings; *Cuii* joining posterior border of wing nearer to apex of wing than base; 10 to 12 postnodal nervures. Head with small, rounded and well-defined postocular spots. Posterior lobe of prothorax small, rounded. Legs short, hind femora extending only to end of thorax, spines short, unequally spaced, the two distal ones closely approximated. Abdomen long and slender, especially segments 3 to 6; segment 10 simple, without a bifid tubercle on dorsum and with apical border straight or barely emarginate. Anal appendages subequal, about equal to length of segment 10; superiors stout incurved hooks, inferiors inclined downwards, with a rounded basal tubercle on inner side and upturned apex. Penis with two pairs of chelate subequal hooks on second segment and with apex of segment 3 strongly bifid. Female: presence of a spine beneath segment 8 cannot be determined as end of abdomen is missing in allotype.

*Habitat.* MARQUESAS ISLANDS: Uapou, Hakahetau Valley, 800, 900, and 1500 feet; Tahuata, Tehue, 650 and 1000 to 2000 feet, and Amatea, 2500 feet.

Genotype *Cœnagrion interruptum* Needham, Pacific Entomological Survey Pub. I, 10, pp. 111-112, Honolulu, 1932. Type in the Bernice P. Bishop Museum, Honolulu, Hawaii. Paratypes in the Department of Entomology, Cornell University, Ithaca, New York.

This new genus belongs to the Selysian Legion 5, and, according to Professor Needham, who has re-examined the paratypes, the caudal appendages of the male are rather unique in that the superiors are short, heavily chitinized in the basal half, and terminate in a pair of long incurving sharp forcipate hooks appearing bare only at the tip, the terminal margin of the basal half forming a ridge bearing a pair of blunt elevated denticles (figs. 1 & 2).

*Note interpolated by F. C. F. :—*

In the last character it differs markedly from both *Agriocnemis* and *Argiocnemis*, but as species of these two genera also differ markedly in the shape of the anal appendages amongst themselves, this character must be regarded as not more than specific in value. Regarding the venation, all that can be said is that the arculus is only slightly distal to the line of the distal antenodal (widely distal in *Agriocnemis* and *Argiocnemis*) and that veins *Mii* and *Mia* arise at a more distal level than in these two genera. Apart from these differences, *Bedfordia*, if not congeneric with the latter, lies extremely close to it.

*Ischnura aurora* Brauer.

NUKUHIVA : Toovii, Teuanui, altitude 2000 feet, October 27, 1929, one male, Mumford and Adamson ; Toovii, Vaihakameama, altitude 2600 feet, November 11, 1929, 23 specimens, Mumford and Adamson ; Tapuaooa, altitude 3100 feet, November 11, 1929, three specimens, Mumford and Adamson ; Tapuaooa, altitude 2600 feet, May 30, 1931, five specimens, Le Bronnec and H. Tauraa ; Tapuaooa, altitude 2750 feet, June 17, 1931, one specimen, Le Bronnec and H. Tauraa.

HIVA OA : Atuona, sea-level, February 7, 1929, three males, three females ; Tahauku, sea-level, July 10, 1929, 11 males, eight females ; Atuona, sea-level, July 11, 1929, five males, four females ; all collected by Mumford and Adamson.

UAFOU : Hakahetau Valley, altitude 2000 feet, January 29, 1930, one male, one female, Le Bronnec and H. Tauraa.

UAHUKA : Vaitiake, altitude 1000 feet, March 24, 1931, three specimens, Le Bronnec and H. Tauraa.

TAHUATA : Hanatetana Valley, altitude 600 feet, July 28, 1930, one male, Le Bronnec and H. Tauraa.

FATUHIVA : Oomoa Valley, sea-level, August 22, 1930, one male, four females, Le Bronnec and H. Tauraa.

Suborder ANISOPTERA.

Family Cordulidae.

*Hemicordulia assimilis oceanica* Selys.

NUKUHIVA : Tapuaoa, altitude 3100 feet, November 11, 1929, one male, Mumford and Adamson ; "Epopukiki," altitude 3000 feet, May 28, 1931, one male, Le Bronnec and H. Tauraa.

Family Libellulidae.

*Rhyothemis* Hagen.

NUKUHIVA : Toovii, Vaihakameama, altitude 2600 feet, November 11, 1929, two nymphs, Mumford and Adamson.

*Pantala flavescens* (Fabr.).

NUKUHIVA : Ooumu, altitude 3890 feet, May 29, 1931, three specimens ; Tapuaoa, altitude 2600-2800 feet, May 30, and June 17 and 18, 1931, nine specimens ; Vaihakameama, altitude 2600 feet, June 19 and July 21, 1931, ten specimens ; all collected by Le Bronnec and H. Tauraa.

HIVA OA : Atuona, sea-level, July 11 and 22, 1929, eleven males, eight females, Le Bronnec and H. Tauraa.

UAHUKA : Hinitaihava Valley, altitude 300 feet, March 10, 1931, one specimen ; Hanahoua Valley, altitude 1150 feet, March 10, 1931, one specimen ; Vaipae Valley, sea-level, March 17, 1931, one specimen ; all collected by Le Bronnec and H. Tauraa.

TAHUATA : Hanatetena Valley, altitude 600 feet, July 28, 1930, one male, Le Bronnec and H. Tauraa.

FATUHIVA : Oomoa Valley, sea-level, August 29, 1930, four males ; Oomoa Valley, sea-level, September 26, 1930, one male ; both collected by Mumford and Adamson.

ELAO : April 23, 1931, three specimens, Le Bronnec and H. Tauraa.

*Tholymis tillarga* (Fabr.).

HIVA OA : Atuona, sea-level, July 22, 1929, six imagoes, Mumford and Adamson.

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LXVI.—*Records of Corrodentia from the Marquesas Islands.\**  
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INTRODUCTION.

In his classic introduction to the 'Fauna Hawaiensis,' Dr. R. C. L. Perkins (1931), writes that *Corrodentia* † are

\* *Studies on Faunal Distribution*, No. 4.—The study of faunal distribution, initiated by E. P. Mumford at Oxford, under my general direction, at the expense of funds received through the Higher Studies Fund at Oxford, the Royal Society, the British Museum (Natural History), and the British Association for the Advancement of Science, has, since the war, received further generous support from the Carnegie Corporation of New York, the National Academy of Sciences, the Society of Sigma Xi, the American Philosophical Society, and the May Esther Bedford Fund, Inc. To all of these organizations, and especially to the officers and Trustees of Stanford University, where the work is now being carried on, grateful acknowledgement is here made, as well as to the Hawaiian institutions ('Nature,' vol. cxxx. No. 3291, pp. 797-798, 803, Nov. 26, 1932), which enabled Mr. Mumford to visit the Marquesas in the first place. See also 'Nature,' vol. cxli. No. 3561, p. 198, Jan. 29, 1938; vol. cxliv. No. 3654, p. 826, Nov. 11, 1939, and vol. cxlviii. No. 3765, p. 789, Dec. 27, 1941, and Mumford, 1936, and Mumford and Adamson 1933.—G. D. HALE CARPENTER, Hope Professor of Zoology (Entomology), Oxford.

† The classification here adopted is that of Pearman (1936). Gurney (1939) concludes that because of priority, general usage and fitting derivation, it seems best to retain the name *Corrodentia* in preference to others.

endemic in the forests of the Hawaiian Islands and, in a few cases, near the coast. Though the status of the Corrodentia of the Marquesas Islands cannot be ascertained so definitely, it is of interest to record here for the first time that a new genus is exemplified by a species from that locality, and the occurrence there of the genera *Lepidopsocus*, *Echmepteryx*, *Cæcilius*, *Peripsocus*, *Ectopsocus*, and *Pseudocæcilius*. The new genus, possibly endemic, seems to be related to the genus *Philotarsus*, though its true affinities cannot at present be determined.

The species of the above-mentioned genera cannot be described now because of disturbed conditions resulting from the war, but the importance of the generic records and accompanying field data is such as to justify publishing them as supplementary to the Pacific Entomological Survey series\*, devoted to the terrestrial and freshwater fauna of the Marquesas.

The new genus is as yet known only from high altitudes in the Marquesas. The genera *Cæcilius*, *Peripsocus*, and *Ectopsocus* are world-wide; the genus *Lepidopsocus* has been recorded from the Seychelles in the Indian Ocean, the Malay Peninsula and Samoa; and the genus *Pseudocæcilius* has been taken in the Seychelles, the Malay Peninsula, Australia, Japan, New Guinea, Fiji, and North and South America, but is apparently absent from Europe. The genus *Echmepteryx* has been taken in Ceylon, the East Indies, Australia, Hawaii, Samoa, and in the New World.

*Pseudocæcilius* may include an endemic element in the Marquesas. It is possible that the collections are not fully representative. Many Corrodentia live in obscure situations where they may escape notice, and some have a short imaginal season, so that the chance of the collector's detecting them would depend upon the period of the year during which collections were made. In estimating the status of the Corrodentia, it is important to study them in relation to their environment and to remember that they are readily introduced and often able to establish themselves in situations where climatic conditions differ widely from those of their original habitats. As stated elsewhere (Mumford and Adamson, 1932; Mumford, 1936), the plants on which the Marquesan insects occur were identified by Dr. E. D. Merrill, now Administrator of the

\* The Pacific Entomological Survey Publications were concluded in 1939.

Botanical Collections at Harvard, the altitudes were taken with a Pauline altimetre, and localities in which collections were made were indicated on sketch-maps drawn up for that purpose.

After the plants had been identified by Dr. E. D. Merrill, of Harvard, they passed into the hands of Dr. F. B. H. Brown (1931 and 1935), who subsequently created, on the basis of these and other collections, endemic species and varieties which are in need of confirmation. Pending final clarification, which awaits critical revision on the basis of the actual specimens in Honolulu, it seems best to follow tentatively Merrill's classification of the Marquesan plants as native or introduced, indicating by footnotes where Brown has described species or varieties. These species, like the Corrodentia taken in association with them, may or may not prove to be endemic.

Grateful acknowledgement is here made to Dr. Merrill, for assistance with the plants. Thanks are also due to Professor G. D. Hale Carpenter, of Oxford, under whose general direction this study of faunal distribution is being carried on, and to Dr. Ashley B. Gurney, of the United States Department of Agriculture, Bureau of Entomology and Plant Quarantine, Washington, D.C., for aid in the preparation of this article.

The specimens, now in the possession of Mr. Pearman, will ultimately be deposited in the Bernice P. Bishop Museum, in Hawaii. They were collected by the writer and his associates on the Pacific Entomological Survey.

### **Lepidopsocidæ.**

*Lepidopsocus*, here recorded from the Marquesas, is represented in Samoa by *hopkinsi*, possibly a colour variety of *nepticulides* from Singapore. In the Marquesas, the genus was taken on most of the inhabited islands at various altitudes up to three thousand feet, and on the uninhabited Eiao. It occurs on *Dodonæa viscosa*, *Piper latifolium*, *Hibiscus tiliaceus*, *Metrosideros collina*, and *Weinmannia parviflora*, all native\*. The specific identity of the specimens of *Lepidopsocus* and *Echmepteryx* has not been established, and the field data for *Echmep-*

\* Only a specialist with access to Brown's (1935) specimens can decide upon the validity of his endemic varieties of *viscosa*, *tiliaceus*, and *collina*. *Viscosa* and *tiliaceus* are very common and variable pantropics, and *collina* is widespread in Polynesia, with numerous local growth forms. No opinion can be expressed as to the validity of *Weinmannia marquesana* and its varieties.



*teryx* are not at present to hand. *Echmepteryx* occurs also in Samoa, Hawaii and elsewhere. The *Echmepteryx* group of genera has been so loosely defined that it is not possible to give more than a general statement until a closer comparison has been made of the morphology.

#### LEPIDOPSOCUS Enderlein.

ELAO : Near middle of island, altitude 1665 feet, on *Hibiscus tiliaceus*, September 28, 1929 ; towards north end east side of island, altitude 1850 feet, September 29, 1929, on *Hibiscus tiliaceus* ; middle of island, altitude 1450 feet, October 1, 1929 ; plateau above Vaituha, altitude 1150 feet, October 2, 1929, on *Dodonaea viscosa* ; all collected by Adamson.

FATUHIVA : Ooma Valley, Otamahe, altitude 280 feet, August 20, 1930 ; Hanavave Valley, altitude 1550 feet, August 23, 1930, beating *Metrosideros collina* ; both collected by Le Bronnec.

HIVAOA : Anatikauae, altitude 1750 feet, August 1, 1929, on *Piper latifolium* ; Mount Temetiu, north-east slope of island, altitude 2400 feet, September 13, 1929 ; both collected by Mumford and Adamson.

NUKUHIVA : Teivipakeka, altitude 2400 feet, October 16, 1929, on *Metrosideros collina*, Mumford and Adamson ; Tevanui, Toovii, altitude 2500 feet, October 25, 1929, beating shrubs, Mumford and Adamson ; Tapuaoa, altitude 3000 feet, June 18, 1931, on *Weinmannia parviflora* and on *Metrosideros collina*, Le Bronnec and Tauraa.

TAHUATA : Hanatuuna Valley, altitude 325 feet, July 19, 1930, Le Bronnec and Tauraa.

#### Cæciliids.

The discovery in the cloud zone on Tekuhepu summit, Uapou, of *Cæcilius analis* Banks, is of interest. This cosmopolitan genus was previously known in the Pacific only from *novoguineensis*, described from New Guinea and since recorded in Fiji and Samoa, *analis* described from Hawaii, and an undescribed species of the same genus, taken in the New Hebrides by Dr. J. R. Baker, and now in the Hope Department at Oxford. The Marquesan field data are as follows :—

#### CÆCILIUS Curtis.

UAPOU : Tekuhepu summit, altitude 3200 feet, November 28, 1931, beating ferns, Le Bronnec.

**Peripsocidae.**

*Peripsocus* has not been recorded hitherto from any of the Pacific Islands east of New Guinea. The single Tahitian species does not appear to agree with any from the Marquesas, and one of the latter is much like a New Zealand form. *Ectopsocus*, on the other hand, has already been recorded from the Bismark Archipelago, Fiji, and Hawaii. The Marquesan material of this genus includes, among other species, *fullawayi*, hitherto known only from Oahu and Laysan in the Hawaiian Islands.

*Peripsocus* was encountered on three of the inhabited Marquesan Islands, and on Eiao. It occurs at all elevations on *Dodonaea viscosa*, *Weinmannia parviflora*, *Metrosideros collina*, and *Styphelia tameiameia*\*, all native, and on the introduced *Abutilon menziesii*.

*Ectopsocus* was encountered in the lowland and lower intermediate zones of four of the inhabited islands, and on Eiao, on *Dodonaea viscosa*, *Premna tahitensis*†, *Glochidion ramiflorum*‡, all native, and on the introduced *Melochia umbellata*, and *Cyperus*§ sp.

**ECTOPSOCUS McLachlan.**

**EIAO** : Middle of island, altitude 1450 feet, October 1, 1929, Adamson ; plateau above Vaituha, altitude 1150 feet, October 2, 1929, on *Dodonaea viscosa*, Adamson ; altitude 1700 feet, April 16, 1931, on *Premna tahitensis*, collected by Le Bronnec and Tauraa.

**FATUHIVA** : Oomoa Valley, sea-level, August 21, 1930, on *Cyperus* sp. ; Ooma Valley, Tetana, altitude 500 feet, August 22, 1930 ; both collected by Le Bronnec.

**HIVA O A** : Ava o a Valley, altitude 1350 feet, January 4, 1932, on leaves of *Glochidion ramiflorum*, Le Bronnec.

**TAHUATA** : Hanamiai Valley, altitude 400 feet, May 28, 1930, on *Melochia velutina* ; Hanahevane Valley, sea-level,

\* No opinion can be expressed as to the validity of Brown's endemic form *marquesensis* of *Styphelia tameiameia*.

† This widespread Polynesian species, originally described from Tahiti, is fairly variable, and a variety could be made for every island in which it occurs, though such work would be utterly without significance.

‡ Questions as to the validity of Brown's (1935) species and varieties of *Glochidion* can be answered only by a specialist with access to Brown's specimens. The species *ramiflorum* is widespread, ranging from Micronesia and the New Hebrides to the Marquesas, and the genus is much in need of revision.

§ The five "endemic" species described or cited by Brown (1931), are questionable.

July 16, 1930, sweeping herbage ; Hanahevane Valley, altitude 15 feet, July 17, 1930, beating *Melochia velutina* ; all collected by Le Bronnec and Tauraa.

UAHUKA : Tahoaikikau, altitude 780 feet, March 18, 1931, on *Sida* sp. ; Vainui, altitude 600 feet, March 18, 1931, on *Sida* sp. ; both collected by Le Bronnec and Tauraa.

#### PERIPSOCUS Hagen.

EIAO : Middle of island, altitude 1450 feet, October 1 1929 ; plateau above Vaituha, altitude 1150 feet, October 2' 1929, on *Dodonaea viscosa* and on *Abutilon menziesii* ; both collected by Adamson.

HIVAOA : Kaava Ridge, Kakahopuanui, altitude 2800 feet, October 27, 1931, beating *Weinmannia* sp. Le Bronnec.

NUKUHIVA : Teivipakaka, altitude 2500 feet, October 16, 1929, on *Metrosideros collina*, Mumford and Adamson ; Tevanui, Toovii, altitude 2500 feet, October 25, 1929, beating shrubs, Mumford and Adamson ; Ooumu, altitude 3000 feet, May 29, 1931, on *Weinmannia parviflora*, Le Bronnec and Tauraa ; Tapuaoa, altitude 3000 feet, June 18, 1931, on *Weinmannia parviflora*, Le Bronnec and Tauraa ; Tekao Hill, 3020 feet, July 23, 1931, on *Cyathodes tameiarnia*, Le Bronnec and Tauraa.

UAPOU : Hakahetau, altitude 500 feet, December 17, 1929, beating, R. R. Whitten : Tekohepu Summit, altitude 3300 feet, November 27, 1931, beating *Weinmannia* sp., Le Bronnec.

#### Pseudocæciliidæ.

*Pseudocæcilius*, hitherto known from the Pacific only from the unique type described from Fiji by Karny (1925), was taken on four of the inhabited islands and on Eiao and Mohotani. It occurs up to three thousand feet on *Eugenia rariflora*\*, *Glochidion ramiflorum*, *Metrosideros collina*, *Premna tahitiensis*, *Weinmannia parviflora*, *Xylosma suaveolens*†, and on undetermined species of *Cyperus*, *Freyinetia*‡, and *Tectaria*§, all native. All of the Mar-

\* On the basis of the work of competent botanists, *E. rariflora* ranges over Polynesia from Hawaii south and west to the New Hebrides.

† The validity of Brown's (1935) endemic variety *angustifolium* is questionable. *X. suaveolens* occurs all over Polynesia.

‡ Brown's (1931) endemic species may be merely local variants of the Hawaiian species.

§ *Tectaria jardini* (Mettenius) is valid and endemic.

quesan species have a peculiarity in venation not shown in species taken elsewhere in the Pacific. They may be endemic, though a species of *Pseudocæcilius* taken by the Survey in Tahiti appears to agree with one of them.

#### PSEUDOCÆCILUS Enderlein.

ELAO : Middle of island, altitude 1450 feet, October 1, 1929, Adamson ; middle of island, altitude 1700 feet, April 16, 1931, on *Premna tahitiensis*, Le Bronnec and Tauraa.

FATUHIVA : Oomoa Valley, Otomahe, altitude 280 feet, August 20, 1930 ; Oomaa Valley, near sea-level, August 23, 1930, on *Cyperus* sp. ; Tevaitapu Valley, altitude 300 feet, August 23, 1930 ; all collected by Le Bronnec.

HIVAOA : Kopaaftaa, altitude 2770 feet, August 2, 1929, miscellaneous sweeping and on *Tectaria* sp. ; Teavauhiaitekohu, altitude 2100 feet, February 15, 1930, on *Glochidion ramiflorum* ; both collected by Mumford and Adamson.

MOHOTANI : above Anaoa, altitude 325 feet, August 13, 1929, on *Eugenia rariflora*, Mumford and Adamson.

NUKUHIVA : Tevanui, Toovii, altitude 2500 feet, October 25, 1929, beating shrubs, on *Weinmannia parviflora*, and on *Metrosideros collina*, Mumford and Adamson ; ridge north of Tevanui, altitude 2800 feet, October 26, 1929, on *Metrosideros collina*, Mumford and Adamson ; Ooumu, altitude 3000 feet, May 29, 1931, on *Weinmannia parviflora*, Le Bronnec and Tauraa ; Tapuaoa, altitude 3000 feet, June 18, June 20, 1931, on *Weinmannia parviflora*, Le Bronnec and Tauraa ; Vaiotekea, altitude 2200 feet, August 6, 1931, beating *Metrosideros collina*, Le Bronnec and Tauraa.

UAPOU : Hakahetau Valley, altitude 900 feet, December 10, 1929, on *Xylosma suaveolens* leaves, R. R. Whitten ; Teavanui, Paaumea Valley, altitude 2900 feet, November 27, 1931, beating *Freycinetia*, Le Bronnec.

#### Philotarsidæ.

##### *Genus novum.*

(*Type* : species nova). The description of the genus provisionally referred to this family will be given in the account of the Marquesan Psocids, to be published by the Bernice P. Bishop Museum, Honolulu.

**NUKUHIVA** : Puokoke on Tunoa Ridge, altitude 3485 feet, October 22, 1929, on *Glochidion ramiflorum*, Mumford and Adamson.

**UAPOU** : Hakahetau Valley, Vaihakaatiki, altitude 2800 feet, November 19, 1931, beating *Freycinetia* sp., Le Bronnec.

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LXVII.—*New Species of Staphylinidæ (Col.) from the Moluccas and Celebes.* By MALCOLM CAMERON, M.B., R.N., F.R.E.S.

*Priochirus (Syncamptochirus) separandus*, sp. n.

Very like *lorquini* Fauv., but differing from it in the following respects:—the frontal impression is a little shorter and wider, the little inner tooth on the front margin is further from the large external tooth, the 1st antennal segment not sulcate throughout but only excavated at the apex, the intermediate segments a little longer, oval; thorax shorter, convex, the sides not straight and parallel, but feebly rounded and much less coarsely punctured. Length 13 mm.

Labuan : Batjan. Type in my collection.

*Holotrochus celebensis*, sp. n.

Black, shining, the posterior margins of the tergites narrowly and obscurely ferruginous. Antennæ and legs reddish yellow. Length 2 mm.

Head with a few small punctures. Antennæ short, the 2nd segment stout, oval, shorter than the 1st, 3rd and 4th small, moniliform, 5th and 6th small, transverse, 7th to 10th much more transverse and increasing in width, the 10th three times broader than long. Thorax slightly transverse (3.75 : 3.2), the sides straight and parallel for the anterior half, posteriorly straight and retracted to the base, the anterior angles a little prominent, the posterior obtuse, not explanate and without fovea, finely and sparingly punctured like the head. Elytra as long as the thorax, with a row of five or six flat obsolete punctures on the disc and a humeral row of four or five others of similar character, otherwise practically impunctate. Abdomen with a few small scattered punctures. The whole insect without ground-sculpture.

S. Celebes : Lompa-Battau, altitude 8000 feet. Type in my collection.

*Osorius dohertyi*, sp. n.

Except for the shorter elytra very similar in build, colour and lustre to *eppelsheimi* Bernh., but differs in the following respects :—the striæ of the head are finer, the fine median keel seen in that species is absent and a median tubercle, at the anterior border is scarcely indicated, the thorax is less retracted behind, the sculpture of similar character but finer and less close, the elytra a little shorter, slightly longer than broad (5.5 : 5), as closely but more finely and superficially punctured, the sculpture of the abdomen as in *eppelsheimi*. Length 7 mm.

Batjan : Labuan (*Doherty*). Unique. My collection.

*Osorius cordaticollis*, sp. n.

Near *cordicollis* Fauv., but differing in the sculpture and build of the thorax and longer and more slender antennæ, the penultimate segments fully as long as broad. The striæ between the eyes are broad, much broader than in *cordicollis*, the rugæ few in number and somewhat irregular, in the middle with a broad smooth area, the declivous front is entirely without striæ, indistinctly coriaceous and at the sides with a few small granules, the anterior border truncate. Thorax slightly transverse (5.5 : 5), the sides in front less parallel than in *cordicollis*, more convergent behind, the constriction before the base less marked, along the middle with a broad impunctate area, the puncturation

very like that of *cordicollis* but not quite so fine or so close; puncturation of the elytra less close, coarser and more obsolete than in that species, that of the abdomen scarcely differing in the two species. Length 7 mm.

Bogor, v.-vi. 1896 (*J. Z. Kannegieter*). Unique. My collection.

*Stenus (Hypostenus) celebensis*, sp. n.

Build, colour and antennal structure of *arachnoides* Bernh., the puncturation of the head similar but that of the thorax and elytra a little coarser and not quite so close, abdomen less coarsely and much less closely punctured on the first four visible tergites, very finely and very sparingly on the 5th and 6th. The elytra are short as in *arachnoides*, only as long as the thorax, the whole insect without ground-sculpture and with only very scanty and short pubescence. Length 5.5 mm.

♂: 2nd and 3rd sternites in the middle posteriorly with quadrilateral impunctate space; 4th distinctly impressed in the middle for nearly the posterior half and there impunctate; 5th impressed the whole length of the middle, the impression deeper anteriorly, sparingly punctured and sparingly pubescent; 6th with an acute triangular excision, its edges bevelled.

N. Celebes: Toli-Toli. Type in my collection.<sup>1</sup>

*Pæderus subcoriaceus*, sp. n.

Moderately shining, black, the anal styles reddish, the elytra with distinct bluish reflex. Antennæ, palpi and legs reddish yellow, the tibiæ and tarsi darker. Length 15 mm.

This species should be very near *coriaceus* Fauv., but to differ in the colour and the less coarsely punctured elytra. Head as broad as the thorax, suborbicular, very slightly longer than broad, the eyes rather small, the post-ocular region long, gently rounded and retracted, between the eyes with two rather large superficial impressions, the clypeal region almost impunctate, the vertex also with an almost impunctate median area, elsewhere moderately finely, superficially and rather sparingly punctured, at the middle of the base with a short impressed line, the surface except the antennal tubercles and the impunctate median area finely but distinctly coriaceous. Antennæ long, the 3rd segment nearly three times longer than the 2nd,

longer than the 1st, 4th to 8th all much longer than broad, clavate, subequal, 9th and 10th a good deal shorter, subequal, 11th a little longer than the 10th. Thorax a little longer than broad (10 : 8.5), widest about the anterior fourth, the sides rounded and retracted in front, almost straightly retracted behind, not at all sinuate as seen from above, in the middle near the base with a short impressed line, broadly impunctate along the middle, elsewhere with fine superficial scattered punctures, the ground-sculpture as on the head. Scutellum practically impunctate, coriaceous. Elytra shorter than the thorax (8 : 10), widened behind, moderately coarsely, asperately punctured, more or less rugulose and without ground-sculpture. Abdomen narrowed near the apex, finely, rather sparingly punctured, coriaceous like the head. The whole insect with longer and shorter sub-erect hairs.

♂ : unknown.

S. Celebes : Bua Kraeng, altitude 5000 feet, ii. 1896 (*Fruhstorfer*). Type in my collection.

*Pæderus rufotestaceus*, sp. n.

Shining, reddish yellow, the head and abdomen darker. Antennæ, palpi and legs reddish yellow. Length 7 mm.

In the build of the head and thorax much resembling *jacobsoni* Bernh., but with larger eyes and shorter thorax, in other respects quite different. Head longer than broad, lozenge-shaped, as broad as the thorax, the eyes rather large, almost as long as the strongly retracted post-ocular region, superficially bi-impressed in front, the disc almost impunctate, the sides closely, moderately finely punctured, the front and impressions with a few larger punctures ; ground-sculpture absent. Antennæ long and slender, all the segments much longer than broad. Thorax a little longer than broad (4 : 3.5), short oviform, very finely and very sparingly punctured and without ground-sculpture. Elytra longer than the thorax (6 : 4), parallel, finely, rather closely punctured and without ground-sculpture. Abdomen finely, rather sparingly punctured, less sparingly on the 7th tergite, which is furnished with a fine membranous border. Head and thorax with a few setæ, elytra with short pubescence, abdomen with a few long setæ and sparing shorter pubescence.

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♂: 6th sternite with deep parallel-sided excision, the apex rounded, the sides bordered.

S. Celebes : Tjamba (*Doherty*). Type in my collection.

*Charichirus ornatus*, sp. n.

Greasy lustrous : head and abdomen black, the posterior margins of the tergites narrowly rufescent : thorax and elytra pitchy, the posterior half of the latter and a short extension along the suture reddish yellow. Antennæ with the 1st segment reddish yellow, the 2nd reddish yellow, ringed with brown, the following brown, the last three reddish. Legs reddish yellow. Length 5 mm.

Of the lustre of *chinensis* Boh., and with the elytral marking of the same shape and extent but of a bright reddish-yellow colour, but of smaller and narrower build, more like *siebersi* Cam., but the sculpture of the head and thorax more obsolete. Head subquadrate, slightly broader than long (3.3 : 3), a little broader than the thorax, the sculpture very close and composed of very small flat obsolete granules each with a minute puncture. Antennæ as in *chinensis*. Thorax as long as broad, trapezoidal, along the middle with fine shining line, the sculpture of similar character to that of the head but much less obsolete. Elytra a little broader and a third longer than the thorax, with fine close granular sculpture. Abdomen very finely and closely punctured and pubescent as in *chinensis*.

♂: 6th sternite broadly, scarcely perceptibly emarginate and scarcely perceptibly crenulate ; 5th slightly emarginate, the emargination furnished with closely-placed black spines.

S. Celebes : Tjamba (*Doherty*). Unique. My collection.

*Thyrecephalus dohertyi*, sp. n.

Black, shining, the elytra and abdomen with strong greenish metallic reflex. Antennæ with the first three segments red, the following blackish, the last three obscurely yellow. Legs pitchy. Length 10–11.5 mm.

♀: build of *albertisi* Fauv., ♀, but differs in the colour and sculpture. The head is without striæ in front, the post-ocular region with a group of small punctures near the eye, elsewhere with very small obsolete scattered punctures and the usual large basal ones ; thorax with a similar very fine scattered puncturation ; elytra more

coarsely punctured than in *albertisi*, subrugose, the humeral stria obsolete; abdomen coarsely punctured as in that species.

Boeroe Island: Ilat (*Doherty*). Type in my collection.

*Thyrecephalus celebensis*, sp. n.

Shining, black, the elytra orange-yellow. Antennæ blackish, the first three segments red, the apex of the 11th sometimes yellowish. Legs reddish yellow. Length 14 mm.

♂: build of *holomelas* Per., ♂. Head with a few small punctures behind the ocular sulcus and a few others on the side behind the eye, otherwise impunctate except for the usual large basal punctures; thorax, except for the marginal punctures, impunctate; elytra as in *holomelas*, but with more numerous punctures between the sutural and humeral stria than in that species; abdomen much more sparingly punctured than in *holomelas*.

S. Celebes: Tamba (*Doherty*). Type in my collection.

*Thyrecephalus puncticeps*, sp. n.

Black: the head with slight, the elytra with more distinct coppery reflex, the thorax and abdomen with distinct greenish reflex. Antennæ black, the 2nd and 3rd segments and base of the 1st reddish. Legs reddish brown, the tarsi lighter. Length 12 mm.

In build very like *javanus* Bernh., but in all other respects different. Head as long as broad, slightly broader than the thorax, the post-ocular region rounded and very slightly dilated, the vertex with small narrow almost impunctate area, the front more shining and with a few small scattered punctures, the rest of the surface closely coarsely and rugosely punctured, the punctures more or less longitudinally confluent. Thorax a little longer than broad and, except for the usual marginal punctures, without sculpture. Elytra slightly longer than the thorax, without humeral stria, coarsely and closely punctured. Abdomen smooth along the middle, elsewhere moderately coarsely and closely punctured.

S. Celebes: Patutuang (*Fruhstorfer*). Unique. My collection.

*Philonthus celebensis*, sp. n.

Shining, black, abdomen slightly iridescent. Thorax with dorsal row of four punctures. Antennæ black. Legs

pitchy black, the anterior and middle coxæ brown. Length 8 mm.

Near *hindustanus* Schub., but larger and more robust, the elytra longer and entirely black, antennæ longer and more slender, eyes larger, thorax more narrowed towards the front. Head as long as broad, orbicular, narrower than the base of the thorax, eyes large and flat, longer than the post-ocular region, median inter-ocular punctures widely separated. Antennæ long and slender, the penultimate segments distinctly longer than broad. Thorax very slightly longer than broad, narrowed towards the front, with dorsal row of four moderate punctures, the posterior one more distant from the 3rd. Elytra longer (6 : 5) than the thorax, moderately finely and moderately closely punctured, less finely than in *hindustanus* and with long black hairs. Abdomen finely and very sparingly punctured, less sparingly on the 5th visible tergite. First segment of the posterior tarsi longer than the last.

♂ : unknown. ♀ : anterior tarsi dilated.

S. Celebes : Lompa-Battau (*Fruhstorfer*). Unique. My collection.

*Philonthus buruensis*, sp. n.

Shining, black, the head and thorax with slight brassy reflex, the elytra blue, here and there with purple coppery reflex. Thorax with dorsal row of four punctures. Antennæ black, the 1st segment yellowish brown, the last two orange-red. Legs reddish yellow. Length 6.5 mm.

In build scarcely differing from *borneensis* Bernh., but more robust and with longer, differently-coloured antennæ, the penultimate segments as long as broad, differently coloured, less finely and more closely-punctured elytra.

♀ : Head broader than long (4 : 3), subquadrate, the eyes large, the post-ocular region slightly retracted backwards, slightly narrower than the thorax, the median interocular punctures widely separated, between the posterior margin of the eye and the neck with three large punctures, the post-ocular region with a few smaller ones ; ground-sculpture fine and wavy. Antennæ with the penultimate segments as long as broad. Thorax slightly longer than broad (5 : 4.5), the sides straight slightly retracted towards the front, with dorsal row of four moderate punctures and two others externally ; ground-sculpture as on the head. Elytra broader and slightly longer (6 : 5) than the thorax, finely and closely punctured. Abdomen

moderately finely, closely punctured at the bases of the segments, much more finely and sparingly elsewhere. Anterior tarsi simple: 1st segment of posterior tarsi as long as the last.

Boeroe: Ilat (*Doherty*). Unique. My collection.

*Philonthus heterogaster*, sp. n.

Black, shining, thorax with dorsal row of five punctures. Antennæ black, the first two segments and the last orange-red. Legs reddish yellow, the middle and posterior tibiæ infusate. Length 6.5 mm.

Very near *forticornis* Cam., the antennæ similarly constructed, but the head in the ♂ broader and larger, the post-ocular region longer and not retracted towards the base, the puncturation of the elytra scarcely differs but the abdomen is much more closely punctured and more pubescent. ♂: head subquadrate, transverse, a little broader than the thorax, the eyes shorter than the temples; median inter-ocular punctures widely separated, two others on each side of the disc, ground-sculpture fine and wavy. Thorax slightly longer than broad, the sides straight and slightly retracted backwards, dorsal row of five moderate punctures, the 5th more remote; ground-sculpture as on the head. Elytra as long as but broader than the thorax, finely, moderately closely punctured. Abdomen finely, moderately closely punctured and pubescent throughout. First segment of posterior tarsi as long as the last.

♂: anterior tarsi dilated. 6th sternite with a triangular excision, its edges without membrane and not bevelled.

N. Celebes: Toli-Toli (*Fruhstorfer*). Unique. My collection.

*Hesperus dohertyi*, sp. n.

This insect must be very similar to *maculicollis* Bernh., and perhaps is only a subspecies. In one example the head is red with a large triangular black marking (the apex behind) occupying the whole area between the eyes, and the post-ocular region also black; in another the head is black, only reddish in front and with two small reddish spots before the base; the thorax has a similar large triangular black mark on the disc but the posterior angles and posterior margin are infusate and the four punctures of the dorsal row are small. The colour-pattern of the elytra scarcely differs from that of *lævigatus* Fauv., but there are more numerous small setiferous punctures than

in that species. The 1st visible tergite is reddish yellow, the 2nd and 3rd black at the base, the 4th much more broadly black, the 5th and 6th entirely so; the tergites are finely punctured at their bases and also have each two rows of fine punctures, one across the middle, the other at the posterior margin. The antennæ have the first four segments red, the last two reddish yellow, the others black; the penultimate segments are as long as broad. Legs entirely reddish yellow. Length 10 mm.

S. Celebes: Tamba (*Doherty*). In my collection.

*Conosoma celebense*, sp. n.

Black, rather shining, the posterior margin of the thorax very narrowly and obscurely reddish, the posterior margins of the tergites rufescent. Antennæ with the first four and last segments yellow, the rest infusate. Legs reddish yellow. Length 4 mm. (Abdomen normally extended).

Intermediate between *ceylanense* Kr. and *brevis* Fauv., the structure of the antennæ very similar to that of the latter, but yet a little longer; thorax broader than in *ceylanense* narrower than in *brevis*, its puncturation and that of the elytra and abdomen much as in *ceylanense*. Thorax transverse (5.5:4). Elytra longer than the thorax (4.5:4). The whole insect finely yellow pubescent. All the tergites with long black lateral setæ.

S. Celebes: Bua Kraeng, altitude 5000 feet (type). Lompa-Battau, altitude 3000 feet (*Fruhstrofer*). Also in Lombok. Type in my collection.

*Astilbus celebensis*, sp. n.

Shining, dark reddish brown, the last abdominal tergite yellow. Antennæ reddish yellow. Legs yellow. the femora a little infusate. Length 3.5 mm.

In build somewhat resembling *memnonius* Er., but with broader head and shorter broader thorax, the antennæ with more transverse penultimate segments. Head very slightly narrower than the thorax, the eye about as long as the rounded post-ocular region, with a few very small scattered punctures and without ground-sculpture. Antennæ with the 3rd segment as long as the 2nd, 4th to 6th very slightly longer than broad and differing but little, 7th as long as broad, 8th to 10th slightly transverse, 11th as long as the 9th and 10th together, all the segments with rather long hairs. Thorax as long as broad, the sides gently rounded in front, straight and retracted behind, the posterior

angles rounded, along the middle with rather broad and distinct impression extending nearly to the anterior margin, the puncturation much less fine than on the head and moderately close; ground-sculpture absent. Elytra shorter than the thorax (2 : 3), depressed, narrower at the base than at the apex, with rather coarse, close rugulose sculpture. Abdomen narrowed at the base and apex, very finely and very sparingly punctured and without ground-sculpture, the 8th tergite gently rounded behind, the 6th sternite a little produced and rounded. Pubescence on thorax and elytra rather long and coarse, on the abdomen fine and very scanty.

S. Celebes : Tjamba (*Doherty*). Unique. In my collection.

*Aleochara (Baryodma) celebensis*, sp. n.

Shining, head thorax and elytra brownish red, the former infusate on the disc, abdomen black, the posterior margins of the first four visible tergites narrowly, 5th more broadly, 6th entirely reddish yellow. Antennæ red, the first two segments and legs reddish yellow. Length 5-6 mm.

Size and build of *brevipennis* Gr., the antennæ similarly constructed, but of different colour, the puncturation of the head and thorax a little finer and closer, elytra as closely but more finely punctured, abdomen more finely and a little more closely punctured. The whole insect without ground-sculpture.

♂ : 8th tergite arcuately emarginate, the emargination finely crenulate.

S. Celebes : Tjamba (*Doherty*). Type in my collection.

*Aleochara* (s. str.) *marginicollis*, sp. n.

Shining, head and thorax black, the latter with the side margins broadly reddish yellow; elytra reddish yellow; abdomen black, the posterior margin of the 5th visible tergite and greater part of the 6th reddish yellow. Antennæ red. Legs reddish yellow. Length 6 mm.

Size, build and antennal structure of *nigra* Kr., but of different colour, punctures of head and thorax larger and not so close, elytra less closely punctured, the punctures asperate, abdomen rather less closely punctured. The whole insect without ground-sculpture.

♂ : unknown.

N. Celebes : Toli-Toli (*Fruhstorfer*). Type in my collection.

LXVIII.—*The Genus Thyridosmylus Krüger, with Notes on the Subfamily Spilosmylinæ (Neuroptera, Osmylidæ).*  
By D. E. KIMMINS, Department of Entomology, British Museum (Nat. Hist.).

[Plates XIII. & XIV.]

*Thyridosmylus langii* (McLachlan, 1870). (Pl. XIII. fig. 2; text-fig. 2 C.)

*Osmylus langii* McLachlan, 1870, Ent. Mon. Mag. vi. p. 197.

*Thyridosmylus langii* (McL.), Krüger, 1913, Stett. Ent. Zeit. lxxiv. p. 87; *id.* 1914, *op. cit.* lxxv. pp. 56, 93.

Of the "long series" from Masuri, mentioned by McLachlan, in his description, only three remained in his collection when it was acquired by the British Museum. Two of these, a male and female, are in good condition, and I have selected the male as *type*. The example in the Museum collection now lacks the abdomen and one hind wing, otherwise I would have selected that as *type*, being the first listed by the describer. McLachlan had also one other example (defective), collected in N. India by Atkinson.

Krüger, in 1914, placed Gerstaecker's *O. perspicillaris* as a synonym of *langii*. I believe this to be incorrect, as *perspicillaris* has the venation of the anterior wing almost entirely dark brown, whilst in *langii* it is pale, marked with the piceous dots of the hair-bases. Examination of more material has suggested the desirability of dividing both species into a number of subspecies, based upon the form and pattern of the wings.

*Thyridosmylus langii angustus*, ssp. n. (Pl. XIII. fig. 3.)

Wings narrower than the typical form, and slightly more acute. Membrane of anterior wing less suffused with yellowish, brownish markings colder in tone. Fenestrate area between the gradate series larger, and the dots of the veins more conspicuous. Cells in the centre of the wings hexagonal rather than quadrate. Abdomen of the type damaged.

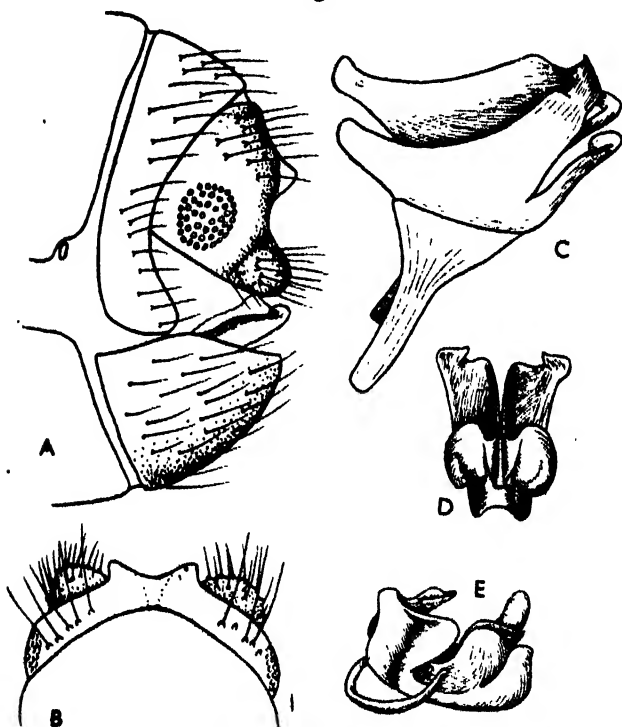
Length of anterior wing 18 mm., of posterior wing 16.5 mm.

Type ♂. 1 ♂, 1 ? paratypes; ASSAM, Khasi Hills.

*Thyridosmylus pustulatus*, sp. n.  
(Pl. XIII. fig. 1; text-figs. 1, 2 A, B.)

Wings more falcate than in *T. langii*, anterior washed with a rather deeper shade of yellow, the pearly hyaline areas more restricted. The wing is sprinkled with numerous round fuscous spots, the membrane in such places being elevated or embossed to form small rounded pustules. Veins (as in *langii*) pale, with numerous piceous dots, the bases of the hairs. Venation of the hind wing more heavily shaded.

Fig. 1.



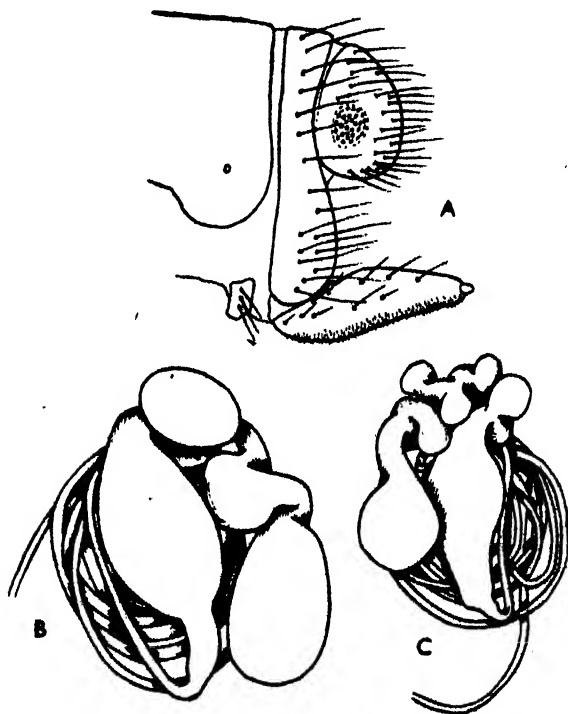
*Thyridosmylus pustulatus*, sp. n. A, apex of abdomen from side; B, ninth and tenth tergite, dorsal; C, tenth sternite, oblique lateral; D, parameres, dorsal; E, parameres, oblique lateral.

Anal plates of male triangular from side, dorsal margins fused and elevated in a pair of small, triangular, slightly divergent processes. Apex of anal plate produced and



globose. Ninth sternite large, triangular from the side, margin rounded from beneath. Tenth sternite arched, narrow dorsally, lateral lobes dilated and produced in fingers basally, apically and ventrally. Apical processes directed somewhat upward, apices curled upward and outward. The whole very thinly chitinised, except the margins, which are thickened and rib-like. Parameres short, curled upward at each end, fused at their extreme

Fig. 2.



*T. pustulatus* and *T. langii*, ♀♀. A, apex of abdomen, lateral (*pustulatus*); B, accessory glands (*pustulatus*); C, the same (*langii*).

bases. Their shape is difficult to describe adequately, and reference should be made to the figures. There is a horseshoe-like structure partly encircling the parameres ventrally.

Length of anterior wing 19.5 mm., of posterior wing 17.5 mm.

Type ♂, paratypes ♂♀; ASSAM, Khasi Hills; 1 ♂, PUNJAB, Simla.

McLachlan determined these specimens as his *O. langii*. I can see no appreciable difference in the male genitalia in the two species, but they are quite different in appearance, and the falcate wings with their embossed spots afford ample characters for separation. There is also a slight difference in the form of the accessory glands of the female. In a cleared example these are seen to be paired and consist each of a long slender tube, coiled in a double spiral, and dilated at its apex into a number of ovate sacs. In *pustulatus* they are large and few in number, four to six; in *langii* there are two rather smaller sacs and a number of small rounded sacs.

*Thyridosmylus perspicillaris* (Gerstaecker, 1884).  
(Pl. XIV. fig. 1.)

*Osmylus perspicillaris* Gerstaecker, 1884, MT. Vorpomm. Rugen, xvi. p. 46.

*Lyemus perspicillaris* (Gerst.), Navás, 1911, Rev. Russe Ent. xi. p. 113.

*Thyridosmylus perspicillaris* (Gerst.), Krüger, 1914, Stett. Ent. Zeit. lxxv. p. 56.

In the McLachlan collection there are five females from Darjiling (the type-locality) which agree entirely with Gerstaecker's description.

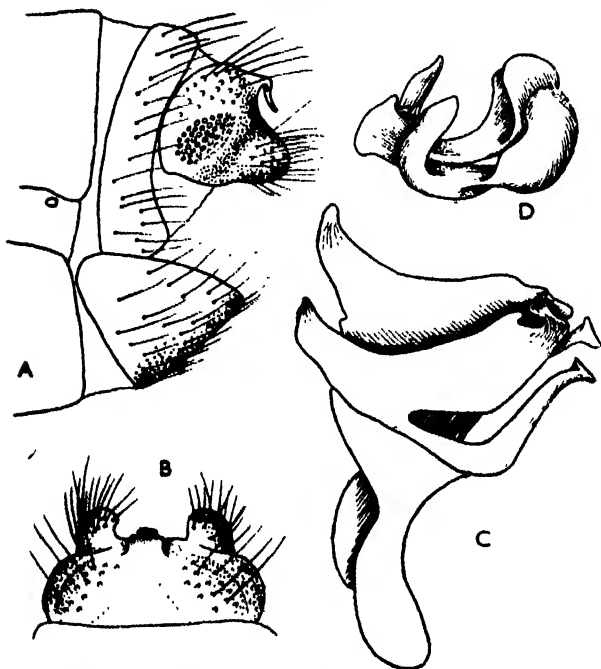
*Thyridosmylus perspicillaris minor*, ssp. n.  
(Pl. XIV. fig. 3; text-fig. 3.)

Smaller and more heavily marked than the typical form. Wings narrower and more acute, venation more open. Anterior wing heavily marked with brownish, particularly in apical and posterior areas. Posterior wing clouded with brownish at apex and along posterior margin; a number of cross-veins edged with brownish. In the male, the genital structures resemble those of *T. langii*, but offer useful specific distinctions. Anal plates smaller, but with a larger group of trichobothria; fused dorsally, the triangular projections of *langii* represented by a small, sinuous tongue. Anterior processes of tenth sternite dilated and truncate. Parameres fused at their extreme bases, apices inflated. In the only male before me, one of the parameres is set at a lower level than the other, but this is possibly an aberration.

Length of anterior wing 15 mm., of posterior wing, 14 mm.

Type ♂, 2 ♀♀ paratypes ; SIKKIM, Phedong.

Fig. 3.



*T. perspicillaris minor*, ssp. n., ♂. A, apex of abdomen, lateral; B, ninth and tenth tergites, dorsal; C, tenth sternite, oblique lateral; D, parameres, oblique lateral.

*Thyridosmylus perspicillaris fenestratus*, ssp. n.  
(Pl. XIV. fig. 2.)

♂.—Unknown.

♀.—Wings slightly narrower and more acute than in *perspicillaris*. Anterior lightly washed with yellowish, except in the hyaline fenestrate areas, brownish markings cooler in tone. Cells in the discal area of both wings tending to hexagonal rather than quadrangular. Hyaline areas larger and more distinct.

Length of anterior wing 19.5 mm., of posterior wing 18 mm.

Type ♀, 1 ♀ paratype; S. INDIA, Nilgiris, Gudulur, 4,000 ft.; 1 ♀, S. INDIA, Travancore, Munnar, 3,000 ft., 30. ix. 32, all collected by Lt.-Col. F. C. Fraser, and presented by him to the British Museum.

The hyaline areas on the anterior wing of this fine insect exhibit the bluish pearly lustre, which is so noticeable in *T. langii* and *T. pustulatus*. It appears to be absent in the typical *perspicillaris*, and in *perspicillaris minor* is replaced by a brilliant greenish iridescence.

The genus *Thyridosmylus* Krüger belongs to the subfamily Spilosmylinæ, and may be distinguished from the other genera as follows:—

1. After the first cross-vein from M to Cu in the anterior wing, a space free from cross-veins ..... 2.  
 No clear space free from cross-veins in this area ..... 4.
2. Second cross-vein from Rs to M in anterior wing arising from the first branch of Rs; fork of M beyond origin of first branch of Rs..... [1914.  
*Conchylosmylus* Krüger,  
 Genotype:—*Spilosmylus aureus* Navás.  
 Second cross-vein from Rs to M arising from the stem of Rs; fork of M before origin of first branch of Rs..... 3.
3. Wings without hyaline fenestrate patches, with or without embossed spot on posterior margin of fore-wing ..... *Spilosmylus* Kolbe, 1897.  
 Genotype:—*Osmylus africanus* Kolbe.  
 Wings with hyaline fenestrate patches, and without an embossed spot on the posterior margin of fore-wing..... [1913.  
*Thyridosmylus* Krüger,  
 Genotype:—*Osmylus langii* McLachlan.
4. Only one cross-vein from Rs before its first branch..... [1913.  
*Thaumatosmylus* Krüger,  
 Genotype:—*Osmylus diaphanus* Gerstaecker.  
 Two to three cross-veins from Rs before its first branch..... [1913.  
*Glenosmylus* Krüger,  
 Genotype:—*Glenosmylus elegans* Krüger.

I am making one important change of generic name in this subfamily. Kolbe (1897) described a species *Osmylus africanus*, and in subsequent discussion said "Den eigenthümlichen convexen Fleck am Hinterrande der Vorderflügel hat *O. africanus* ausser mit *interlineatus* noch mit *tuberculatus* Wlk. (Ostindien), *inquinatus* McL. (Molukken, Ceram) und *modestus* Gerst. (Java) gemein." Later in this paragraph he proposes for these species the subgeneric name *Spilosmylus*. I think it should be obvious, although not stated in so many words, that Kolbe intended his

*africanus* to be typical of the subgenus. Next we have Navás, who, in 1911 (Rev. Zool. Afr. i. p. 235), writes: "Kolbe, dans son memoire *Die Netzflügler Deutsch-Ostafrikas*, Berlin, 1897, page 34, forme le sous-genre *Spilosmylus* pour *Osmylus africanus*." He (Navás) then proceeds to elevate *Spilosmylus* to the rank of genus and takes as genotype *Osmylus tuberculatus* Walker, as it is the earliest species in the group. This course of action is not only unnecessary, but I think there are grounds for considering his earlier sentence (quoted above) as a fixation of genotype.

Banks (1913, Trans. Amer. Ent. Soc. xxxix. p. 214) quotes *O. africanus*, as type, but Krüger, in the same year, accepts Navás, and erects a new genus, *Ripidosmylus*, for *O. africanus* Kolbe. I think he is correct in considering *africanus* and *tuberculatus* to be generically distinct, but his *Ripidosmylus* will of course become a synonym of *Spilosmylus* Kolbe, having the same genotype. *Spilosmylus* Navás will therefore require a new name; the differences separating it from *Conchylosmylus* Krüger are rather slight (the number of gradate series, position of the embossed spot, and the number of parallel streaks in the subcostal area). I propose, therefore, rather than propose a new name for *Spilosmylus* Navás, to consider it congeneric with *Conchylosmylus*.

A large number of genera have been erected by Krüger as allied to *Spilosmylus* Kolbe upon slight venational characters, and whether or not the embossed spot is present in one or both sexes. As in some cases, only one sex is known, this character is not very reliable, and I think the better course is to consider them at present as synonyms of *Spilosmylus*. These generic names, with genotypes, are listed below:—

*Centrolismus* Navás, 1917 (type *C. epiphanes* Navás, 1917).

*Grammosmylus* Krüger, 1914 (type *Spilosmylus punctatus* Navás, 1912).

*Heliosmylus* Krüger, 1915 (type *Glenosmylus krügeri* Esben-Petersen, 1914).

*Kelidosmylus* Krüger, 1914 (type *Ripidosmylus togoensis* Krüger, 1914).

*Lysemus* Navás, 1911 (type *Osmylus harmandinus* Navás, 1910).

*Ostreosmylus* Krüger, 1914 (type *Osmylus inquinatus* McLachlan, 1870).

*Ripidosmylus* Krüger, 1913 (type *Osmylus africanus* Kolbe, 1897).

*Stigmatosmylus* Krüger, 1914 (type *St. ocellatus* Krüger, 1914).

EXPLANATION OF THE PLATES.

PLATE XIII.

Fig. 1. *T. pustulatus*, sp. n.

Fig. 2. *T. langii* McL.

Fig. 3. *T. langii angustus*, sp. n.

PLATE XIV.

Fig. 1. *T. perspicillaris* Gerst.

Fig. 2. *T. perspicillaris fenestratus*, sp. n.

Fig. 3. *T. perspicillaris minor*, sp. n.

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LXIX.—On Species of *Dactylosternum* related to subquadratum (Fairm.) and the Description of a new Genus Rhombosternum related to *Dactylosternum* (Coleoptera, Palpicornia). By J. BALFOUR-BROWNE, M.A., F.Z.S., F.R.E.S., Department of Entomology, British Museum (Natural History).

*CYCLONOTUM SUBQUADRATUM* was described by Fairmaire (1849) from Tahiti in the Society Islands. It was apparently first correctly ascribed to *Dactylosternum* by Sharp (1908). d'Orchymont (1937) records it from Fiji, Samoa, Hawaiian Islands, Buru, Borneo and the Philippine Islands. I have recorded it from the New Hebrides (1939), and I have seen specimens from Larat, Timor Laut Islands (F. Muir, collector). A unique from Damma (Dammer, South-West Islands), a female, is labelled "*Dactylo-sternum* prope subquadratum Fairm. ou var.?" in d'Orchymont's handwriting. Other described species closely related are :—

*Dactylosternum seriatum* Knisch, 1921.

*Dactylosternum bakeri* d'Orchymont, 1925.

*Dactylosternum bryanti* d'Orchymont, 1925.

*Dactylosternum densepunctatum* d'Orchymont, 1937.

From New Guinea I have only seen a single female, from the Huon Gulf, which may be *subquadratum* but is indeterminable with certainty in the absence of males.

d'Orchymont (1926) says of *D. subquadratum* that it "appears to be tolerably variable, even according to the

individuals in my cabinet from the Hawaiian Islands. Those of Manila are reddish (immature) and the other two (Mt. Banahao and Imugan, Boettcher leg.) recorded here have the punctuation and scratching of pronotum very much finer, especially the specimen from Mt. Banahao. . . . There is also a specimen in the British Museum from the Philippine Islands, without exact locality." He also suggests that *D. seriatum* Knisch is "perhaps not entitled to specific rank."

In (1927), he says of *D. seriatum-titanicum* Knisch (1942) that it is "in my opinion certainly this species (*subquadratum*)." I have seen the unique type, from Apia, of *titanicum*, a female (mesocerci seen), and there is no doubt that it is the true *subquadratum*, comparing in every respect with the Tahitian specimens. On the other hand, *seriatum* is an abundantly distinct species by the ædeagus, apparently nearer *waigeuense*, nov., than to *subquadratum*. As stated by d'Orchymont, *seriatum* appears to replace *subquadratum* in Sumatra, Java, Engano, Mentawai and Indo-China, though I have seen no specimens from the latter locality. From the Philippine Islands and Malaya both these species appear to be replaced by *dohertyi*, nov. Penang has *bakeri* d'Orch. and Borneo has *bryanti* d'Orch., each, apparently, to the exclusion of all the others. The Melanesian area is more confused, apparently owing to less material being available.

The true *subquadratum* (Fairm.) I have seen from the Society Islands : Tahiti (topotypes), Moorea and Raiatea. This species has the ædeagus as in fig. 1 a, with the parameres evidently longer than the broad, truncate median lobe. This type of ædeagus has been seen in specimens from Samoa : Upolu, Tutuila and Manua ; Fiji Islands : Vanua Levu, Viti Levu and Taveuni ; Hawaiian Islands : Hawaii, Maui, Oahu and Kauai ; Mangareva Islands : Mangareva ; Austral Islands : Tubuai and Rapa (Oparu) ; New Hebrides : Santo, Malekula and Tanna ; Timor Laut Islands : Larat. The unique from Damma, as also the unique from New Guinea : Huon Gulf, are both females, and their identification remains doubtful. I have seen no specimens from Buru. The only specimens I have seen from Borneo are not of this species but belong to *bryanti* d'Orch. I have only seen two specimens from the Philippine Islands, a pair, one of which was identified by d'Orchymont as *subquadratum*, but they are not this

species. They belong with a short series from Malaya (Corbett, collector) which have a closely similar ædeagus (fig. 1 b), with the median lobe truncate, much more strongly curved than in *subquadratum*, and the parameres evidently longer than in the compared species with the apices not nearly so broad and flattened. This species is undescribed, and for it I propose the name *corbeti*.

Very recently I received two specimens of *Dactylosternum* from Fiji, one of which was a female of *subquadratum*, but the second was a male of a sharply distinct species with a pointed median lobe of the ædeagus, and the parameres only just as long as the median lobe. This discovery was somewhat surprising, and was the ultimate cause of the present revision of the species of the group. It is

Fig. 1 a.



Fig. 1 b.

Fig. 1 a.—*Dactylosternum subquadratum*, sp. n.Fig. 1 b.—*D. corbeti*, sp. n.

evident that a revision of all museum material is required to limit the distribution of the species belonging to this group, and that much further material from both the Indo-Melanesian and Polynesian regions is desirable.

I describe herein five new species : *leveri* (Fiji), *dohertyi* (Perak and Siam), *corbeti* (Malaya and Philippines), *papuense* and *waigiuense* (both New Guinea). Other described species that may be confused are *bryanti* d'Orch. and *bakeri* d'Orch. (the latter species being unknown to me in nature).

***Dactylosternum leveri*, sp. n. (Fig. 2.)**

Oblongo-ovale, nigrum, modice convexum ; antennarum clavæ laxè articulatæ ; elytris seriato-punctatis, seriebus vix canaliculatis, intervallis planis, irregulariter levissime sparse punctulatis ; prosterno medio haud, segmento basali abdominis in medio longitudinaliter carinato ; tarsis brevibus, his posticis articulis tribus basalibus subæqualibus ; elytris extis haud explanatis.

FIJI ISLANDS : Viti Levu, Nandarivatu, 24. vi. 1941 (*K. A. Lever Coll.*) (C. 1152).

Type : unique ♂ (left elytron missing). Long. 4.0 mm  
*Ann. & Mag. N. Hist. Ser. 11. Vol. ix.* 59



Head dull, fusco-rufous, more rufous anteriorly, rather densely and shallowly punctured, the punctures appearing somewhat imbricate, the interstices very sharply and closely reticulate, the areolæ very small and round or pentagonal. Antennæ 9-segmented, the club loosely articulated; palpi rufous. Pronotum blackish, transverse, the anterior angles widely, the posterior sharply rounded, nearly rectangular. Punctuation very fine, from each puncture two very short incipient reticulations arise; interstices moderately shining, under a high magnification a very much effaced reticulation of small round areolæ can just be discerned. Elytra black, with ten series of punctures, each puncture separated from that in front of and behind it by about its diameter; inner series much reduced on the disc, the punctures becoming larger on the posterior declivous portion of the elytron; lateral series (7-10) of large punctures over the whole length.

Fig. 2.

*Dactylosternum leverii*, sp. n.

barely impressed in very shallow striæ as is the first, or sutural stria in the apical quarter. Apico-lateral edge not or barely explanate. Inter-series flat, irregularly and very sparsely punctulate, moderately shining with a suggestion of a very much effaced reticulation of small round areolæ.

The exceptional sculpture of the head and the almost unexplanate elytral edges distinguish this species from all others of the group. The unique is unfortunately in bad condition and cannot risk removal from the support to study the morphology of the meso- and metasterna.

***Dactylosternum dohertyi*, sp. n. (Fig. 3 a.)**

(Oblongo-ovale, mediocriter convexum, supra nigrum, extus vix explanatum; antennis novem articulatis, clavâ laxè articulatâ, palpisque rufo-flavis; elytris seriato-punctatis, seriebus haud canaliculatis, intervallis planis, irregulariter sed dense duplo-punctatis; prostito haud, segmento basali abdominis distincte in medio longitudinaliter carinato; mesofemoribus subtus dense pubescentibus; tarsis brevibus, posteriorum articulis tribus basalibus fere æqualibus.

**PERAK :** Mts. (*Doherty, Fry Collection*) ; L. C. (*ibid.*) ; (*ibid.*). **SIAM :** Renong (*ibid.*). **JAVA (?)** (*Bouring*).

**Type :** Siam, Renong, ♂, long. 3.81 mm., lat. 2.27 mm. (Size range :  $4.09 \times 2.63$ – $3.18 \times 2.18$ ).

Black. Head and dorsum shining, head rather closely and moderately punctured, interstices shining, without vestige of reticulation ; mentum transverse, anteriorly very weakly emarginate, finely and very densely rugose punctate, dull ; antennæ and palpi rufo-flavous ; pronotum distinctly transverse, the emargination for the head very shallow, anterior angles widely, posterior abruptly rounded, nearly rectangular, surface very shining between the punctures, which are a little less dense but the same size as those of the head. Elytra apparently 10-seriate, the series not at all impressed in striæ, the punctures not very large and

FIG. 3 a.



FIG. 3 b.

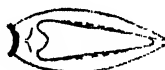


FIG. 3 a.—*Dactylosternum dohertyi*, sp. n.

FIG. 3 b.—*D. densepunctatum*, d'Orch.

separated by their diameters. Inter-series densely and closely punctured with two sizes of punctures, the larger as big as those of the series, the smaller extremely minute but distinctly impressed. The large size of the primary punctures of the inter-series makes it difficult to distinguish the series, particularly laterally and posteriorly. Pronotum not at all carinate, barely even weakly tectiform in the middle line ; mesosternum with the elevated area elongate, the anterior edge marked by a strongly arcuate margin, the anterior face abrupt. Mesofemora beneath very finely and densely punctured and with a short hydrofugal pubescence except at the extreme posterior margin and at the "knee." Metafemora shining, with a few large punctures and a longitudinal reticulation.

This species is superficially very similar to *D. densepunctatum* d'Orchymont by the type of elytral sculpture, but is easily distinguished by the simple, not double, punctuation of the head and the more elongate and narrower form. It is similar in the character of the mesofemora but is distinct in the metafemora, which, as described, have no hydrofugal pubescence. The sedeagus

is very similar to that of *densepunctatum* (fig. 3 b), but the parameres are distinctly broader and the median lobe more sharply pointed.

The unique from Java is a female and is placed here with some doubt, since the head has a certain amount of double punctuation but the elytra are not so explanate as in the compared species and the femora are as described for *dohertyi*. Males from this island are required to confirm the identification.

***Dactylosternum corbetti*, sp. n. (Fig. 1 b.)**

(Ovale, modice convexum, supra nigrum, extus mediocriter explanatum; antennis novem articulatis, clavâ laxè articulatâ, palpisque rufo-flavis; elytris seriato-punctatis seriebus postice vix canaliculatis, intervallis planis, parce subtilissime punctulatis; mento quadrato, antice excavato, subtile reticulato; prosterno haud, segmento basali abdominis distincte longitudinaliter carinato; mesofemoribus subtus fortiter sed non copioso setigero-punctatis, longitudinaliter subtile reticulatis; lævis; tarsis brevibus, posteriorum articulis tribus basalibus subæqualibus.

**MALAYA:** Embi Road, 21. i. 1935; Kuala Lumpur, 21. i. 1935; Setapak, 1. iii. 1935, 3. v. 1935. **PHILIPPINE ISLANDS** (without further information). (*Dactylosternum subquadratum* Fairm., A. d'Orchymont det.)

**Type:** Malaya: Embi Road, ♂, long. 3.63 mm., lat. 2.36 mm. (Size range: 4.27 × 2.54–3.36 × 2.09.)

Black, shining. Head rather closely and finely punctured, each puncture connected with two neighbouring punctures by a fine impressed line forming a loose reticulation, which tends to be rather transverse. Mento quadrate, anteriorly shallowly excavated, closely and finely reticulated with a few scattered large shallow punctures. Pronotum shining, finely and less densely punctured than the head, with an incipient net reticulation formed by two diverging lines at each puncture, but which do not connect with neighbouring punctures. Prosternum very weakly tectiform in the middle line longitudinally, not at all carinate. Elytra seriate punctate, the three inner series on the disc with small punctures which gradually become larger on the posterior declivous portion, the sutural series there becoming distinctly impressed as a stria. The external series of larger punctures weakly sunk as striæ, the intervals flat, weakly and sparsely punctulate, the punctures being almost short scratches. The general surface

of the elytra less shining, in certain lights there is a suggestion of a very much effaced reticulation of small round areolæ.

This species is very close to *subquadratum*, but the serial punctures are rather coarser laterally and posteriorly and the three basal metatarsal segments are more clearly equal in length. The aedeagus is very similar, slightly narrower, more curved apically, and the parameres are proportionally longer and less flattened apically. This form might with equal propriety be treated as a subspecies of *subquadratum*, but I prefer to treat it as a valid species until a sufficient material is obtained fully to judge the variation of that species over its whole range.

***Dactylosternum papuense*, sp. n. (Fig. 4 a.)**

Oblongo-ovale, sat convexum, supra nigrum, extus sat explanatum; antennis palpisque rufo-flavis, mento antice excavato, quadrato, lateraliter sat dense punctulato, medio subtile reticulato; prosterno in medio longitudinaliter tectiforme, segmento basali abdominis longitudinaliter carinato; elytris decem-seriato-punctatis, postice plus minusve canaliculatis, intervallis planis, subtile punctulato-reticulatis; mesofemoribus subtus sat dense fortiterque setigero-punctatis, longitudinaliter subtile reticulatis; tarsis brevibus, posteriorum articulis tribus basalibus progressè diminuendis.

PAPUA: Ishurava, 3000 ft., vii. 1933 (*Miss L. E. Cheesman Coll.*); Kokoda, 1200 ft., vii. 1933 (*ibid.*); Orori, 3000 ft., vii. 1933 (*ibid.*).

Type: Papua: Ishurava, 3000 ft., vii. 1933, ♂, long. 4.63 mm., lat. 2.72 mm. (Size range: 5.0 × 3.0–4.09 × 2.71).

Head black, anteriorly somewhat rufescent, finely and rather densely punctured, each puncture with two divergent impressed lines that may or may not reach their neighbouring punctures so that the surface has an incomplete reticulation. Pronotum similarly sculptured but the tendency is for the divergent scratches seldom to reach a neighbouring puncture. Elytra with ten series of punctures which are not very large on the disc, but posteriorly and laterally they become larger and somewhat impressed in striæ, particularly in the case of the sutural stria on the posterior declivous portion of the elytra; the margins moderately explanate, especially posteriorly. Intervals flat, rather finely and moderately densely punctulate, each puncture, as on the head and pronotum, with

two very short divergent scratches. Prosternum weakly tectiform longitudinally in the middle line. Raised keel of the mesosternum rather narrow, rounded, anterior "arrow-head" carina rather compressed. Mesofemora strongly and moderately densely setigerate-punctate, metafemora more weakly and sparsely so. Three basal

Fig. 4 a.

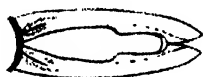


Fig. 4 b.

Fig. 4 a. —*Dactylosternum papuense*, sp. n.Fig. 4 b. —*D. waiguenense*, sp. n.

segments of the post-tarsus progressively shorter. Posterior dorsal edge of the metafemora with a band of irregularly placed, rather dense, backward-projecting short bristles. Aedeagus rather distinct from all others of the group except the following species.

***Dactylosternum waiguenense*, sp. n. (Fig. 4 b.)**

Oblongo-ovale, sat convexum, supra nigrum, sat explanatum; antennis novem articulatis, clavâ laxè articulatâ, palpisque rufo-flavis. Elytris decem-seriatis, haud canaliculatis; prosterno in medio vix longitudinaliter tectiforme; segmento basali abdominis in medio longitudinaliter carinato; mento quadrato, antice mediocriter excavato, postice lateribusque sat dense rugoso punctato; mesofemoribus subtus sat dense fortiterque setigero-punctatis, longitudinaliter distincte reticulatis; metafemoribus subtus sparse tenuèque punctatis, minus distincte reticulatis; tarsis brevibus, posteriorum articulo primo, secundo tertioque simul sumptis fere æquale.

DUTCH NEW GUINEA (North): Waigou, Camp Nok, 2500 ft., iv. 1938 (*Miss L. E. Cheesman Coll.*).

Type: ♂, unique, long. 4.36 mm., lat. 2.72 mm.

Black, shining. Head finely and densely punctured, with a reticulation of divergent scratches from each puncture that rarely reach a neighbouring puncture; pronotum similarly, but a little less closely punctured. Menthum quadrate, excavated in front, the excavation finely, but not very sharply reticulated, the remainder of the surface rather strongly but not coarsely rugose-punctate. Elytra 10-seriate-punctate, only the sutural on the declivous portion becoming obscurely striate, the punctures not

increasing much in size posteriorly or laterally, generally separated by one-and-a-half to two times their diameter. Intervals flat, on the disc sparsely, laterally and posteriorly more densely finely punctured, with the divergent scratches almost forming a reticulation in the area between the anterior part of the tenth series and the false margin. Mesosternum much laterally compressed, so that the raised longitudinal portion is distinctly carinate, not rounded or tectiform. The carina continues over the anterior half of the raised (inter-coxal) portion of the metasternum.

This species is rather similar to the preceding one in size and form. The uniformity in size of the serial punctures is easily noticed on a comparison. The *sedeagus* is absolutely distinct.

**Rhombosternum, gen. nov. Sphæridularum.**

Capite ante oculos marginibus rectis, non angulatis; oculis parvis; antennis novem-articulatis; prosterno ante coxas longe extenso; mesosterno in medio longitudinaliter elevato, lateribus non abrupte declivis, antice carinâ late capite saggitarii formante; scutello longitudine latitudine fere æquale; elytris decem-striatis, secundo tertioque postice abbreviatis; segmento basali abdominis in medio longitudinaliter carinato; tarsis brevibus, articulis tribus basalibus fere æqualibus; metasterno lineis post-curvatis ad medium metepisterni attingendis.

Genotype: *Dactylosternum wagneri* Knisch.

This new genus is erected for two species, *wagneri* Knisch and *birmanense*, sp. nov., which cannot belong to *Dactylosternum*, s. str., by the morphology of the meso- and metasterna. The very wide "arrow-head" of the mesosternal transverse carina and the sloping sides of the mesosternal elevation, coupled with the flat or broadly convex metasternal tabella without laterally compressed intermesocoxal process, and the backward-curving "false sutures" of the metasternum, that reach to at or beyond the middle of the metepisternal-metasternal suture, are evident generic distinctions. The new genus runs to *Protosternum-Blanodium* couplet 15 of d'Orchymont's key to the genera of the Sphæridiinae, and appears to be closer to *Blanodium* by the greater development of the "false suture" (the "carène courbée" of d'Orchymont), but it is evidently quite separate from that genus by the definite "arrow-head" shape of the anterior carina of the mesosternal elevation.

On the other hand, the genus approaches *Mucetum* in the strong development of the femoral ridges (the "bûtes fémorales" of d'Orchymont) right up to the mesocoxal cavities, whereas in *Blanodium* these fade out before reaching the coxal cavities.

This is an interesting development in the phylogeny of the Sphæridiinae, in which the final laterally compressed "arrow-head" type of the mesosternal elevation seen in *Dactylosternum* is definitely indicated.

***Rhombosternum birmanense*, sp. n.**

Ovale, supra nigrum, sat convexum, extus vix explanatum : capite sat crebre punctato, antice rufescente ; antennis novem-articulatis, clavâ laxè articulatâ, palpisque rufo-flavis ; mento subquadrato, antice excavato, sat crebre punctato, interstitiis reticulatis ; pronoto transverso, crebre punctato ; prosterno in medio antice longitudinaliter carinato, antice dentato ; elytris decem-striatis, secundo antice ut alteris longe, intervallis planis, sat dense sat fortiter punctatis ; mesosterno in medio ante coxas sat elevato, antice carinâ sat late capite saggitarii formante, anticem et posticem sat longe longitudinaliter carinato ; metasterno haud carinato, aream vagam rhomboidalem fortiter punctatam formante ; mesofemoribus subtus punctis fortis parce, præcipue versus basin, dispositis ; segmento basali abdominis in medio longitudinaliter carinato ; tarsis brevibus, articulis quattuor basalibus posteriorum sub-æqualibus.

BURMAH : Ruby Mines District (*Doherty, Fry Collection*).  
4 specimens.

Type : ♀, long. 3.36 mm., lat. 2.09 mm.

This species is very similar to *wagneri* in size and form, but may readily be distinguished by the fact of the second stria as long as the rest, not anteriorly abbreviated as in *wagneri*. The prosternal carina is less developed, fades out without reaching the apex, the mentum is dull, reticulate, whereas in the compared species the interstices of the punctures are strongly shining.

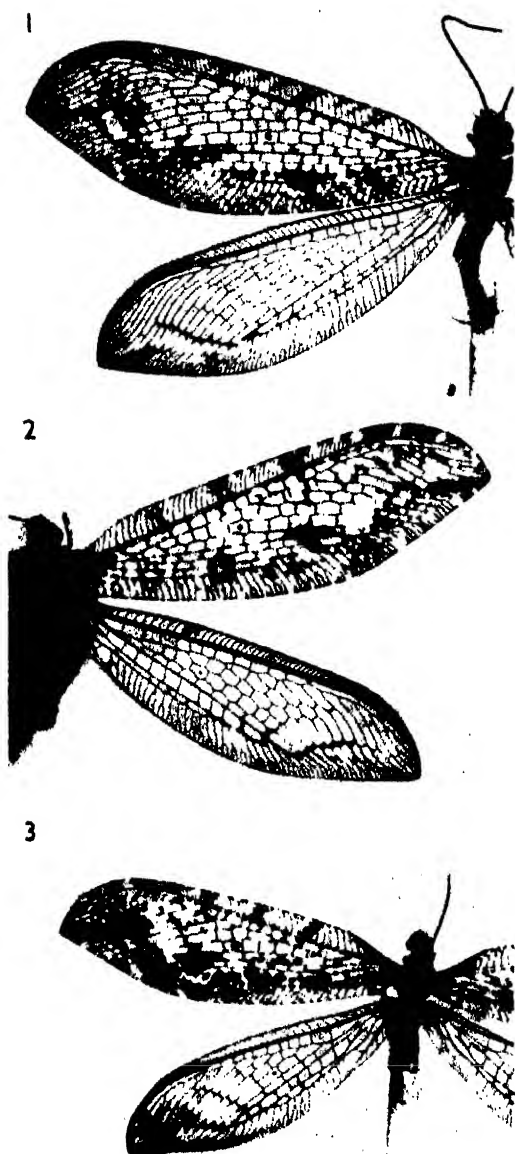
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1 *Thyridosmylus pustulatus* 2 *T. langii*.  
3. *T. l. angustus*.





1. *Thyridosmylus perspicillaris*. 2. *T. p. fenestratus*.  
3. *T. p. minor*.

# THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 60. DECEMBER 1942.

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LXX. *The Insects of Norfolk Island, including a Preliminary Report on a recent Collection.* By C. N. HAWKINS, F.R.E.S.

(Figures in brackets, thus: (7), refer to the Bibliography at the end of this paper.)

PROFESSOR G. D. HALE CARPENTER has recently obtained through the "Island Fauna Fund" of the University of Oxford, aided by a grant from the Royal Society, a number of insects from Norfolk Island, collected by Mrs. Ida McComish, wife of Capt. J. D. McComish, and the opportunity has been taken in this paper to collect together, from various scattered sources, all available information as to the insect fauna of the island, and at the same time to endeavour to deal, so far as is possible under present war conditions, with those insect orders represented in Mrs. McComish's collection. Owing, however, to these same war conditions and the consequent dispersal of, and difficulties of access to, collections and literature, it is very possible that I have overlooked some previous records, and that some species now noted as unidentified are, in fact, already known and recorded from this locality. So far as Mrs. McComish's material is concerned, this paper is, to a considerable extent, really a compilation of information and identifications supplied by experts in the various orders; but with regard to the Lepidoptera I have had a much more personal part in working out the material, and must, therefore, accept

most of the responsibility for any errors which, unfortunately, may have occurred. Generally speaking, the insect fauna of this somewhat remote island appears to have been but little worked, and it would undoubtedly well repay a much more intensive collecting effort. As to the economic matters touched on in this paper, it is hoped the notes may be of some assistance to cultivators on this and neighbouring islands, but much useful further information on this aspect of the various species can be obtained from such works as the 'Handbuch der Pflanzenkrankheiten,' by Dr. L. Reh and others, Berlin, 1932; Metcalf and Flint's 'Destructive and Useful Insects,' New York, 1928; Henry L. Sweetman's 'The Biological Control of Insects,' New York, 1936; and many of the Bulletins of the U.S. Department of Agriculture. Before ending these introductory remarks I must gratefully acknowledge much kind help in their various spheres by the following gentlemen:—Capt. N. D. Riley, Sir Guy A. K. Marshall, Drs. K. G. Blair, O. W. Richards and J. Smart, Messrs. G. J. Arrow, G. A. Bisset, W. E. China, H. St. J. K. Donisthorpe, A. G. Gabriel, D. E. Kimmins, F. Laing, M. E. Mosely, G. E. J. Nixon, L. B. Prout, H. Stringer, G. Talbot and W. H. T. Tams.

### LEPIDOPTERA.

Mrs. McComish's collection consisted of 52 specimens of Rhopalocera belonging to 4 species, and 159 specimens of Heterocera belonging to some 29 species (a few specimens of Tineidae are so badly worn and damaged as to be quite unidentifiable). Evidence of the probable value of more intensive collecting in this island, even in such an Order as the Lepidoptera, may be seen in the fact that whereas Meyrick (1), Olliff (2), Turner (4 and 5), Waterhouse and Lyell (6), and Scott (8) together recorded 45 species (including two indeterminable) of Lepidoptera, the present collection contains some 33 species, of which 11 only, i.e. *Papilio amphiaras* Feld. (*ilioneus* Don.) (2), *Cepora perimale perimale* Don. (3 and 6), *Agrotis ipsilon* Hufn. (*ypsilon* Rott.) (4), *Leucania unipuncta* Haw. (4), *Proxenus tenuis* Butl. (4), *Xanthorhoë sodaliata* Wlk. (4), *Scopula rubraria* Dbl. (1, 2 and 4), *Diasemia delosticha* Turner (5), *Hymenia recurvalis* Fab. (as *fascialis* Cram.)

(4), *Urocidoosema plébeiana* Zell. (4), and *Opogona omascopa* Meyr. (4) are mentioned in the earlier lists. Of the Pyralidæ previously recorded but not included in the present collection, Meyrick (1) records *Trichophysetis neophyla* Meyr. and Turner (4) gives *T. cretacea* Butl. Hampson regarded *neophyla* as a synonym of *cretacea*; but Tams (7, pp. 256, 257) agrees with Meyrick in rejecting this view, and holds the opinion that in the present instance Turner was probably misled by Hampson, and that, not having seen Japanese specimens of true *cretacea*, he misidentified his Norfolk Island material as *cretacea* Butl. when it should really have been recorded as *neophyla* Meyr., thus agreeing with Meyrick's own record from the island. Again, Meyrick (1, p. 239) records *Diasemia grammalis* Dbl. from here, but from his remarks it seems almost certain that his specimen was really the *D. delosticha* subsequently described and named by Turner (5). If these views are correct it reduces the total number of previously recorded species to 43. In addition to this, amongst the Rhopalocera previously recorded Olliff (2) gives *Danaus plexippus* Linn. In all probability the species really meant was *D. menippe* Hb., which is included in the present collection, the error having arisen through the past confusion of names. On these assumptions the total number of species now listed as occurring in the island is 64, of which 10 are still undetermined. Owing to the present conditions, and on account of the small quantity and poor condition of some of the material, I have not described or named any new species on the present occasion, though I suspect there are one or two, as indicated in the "List." As to the arrangement of this section of the paper, I have given in the first place, so far as I have been able to trace them, a complete list of all the lepidopterous species now and previously reported from the island; also particulars of some specimens already in the British Museum which it is desired to take this opportunity of placing on record, with bionomic and collecting notes relating to those species obtained by Mrs. McComish, and including a description of the male of *Cepora perimale perimale* Don. and biological notes on some of the other species. This is followed by a distribution table, and finally, there are some notes on species of economic importance. It is

hoped this may render the present paper of greater value to future workers.

*List of recorded Species, including those in Mrs. McComish's Collection (marked with a \*), and specimens in the British Museum (marked "B.M.").*

(All dates are for 1939.)

## RHOPALOCERA.

### Danaidæ.

*Danaus plexippus* L. (2). Almost certainly an error for next species owing to past confusion of names.

\**Danaus menippe* Hb. and pupæ. 2 ♂, 2. ii., 150 ft., in "Rocky Point Reserve," and 6 ♂, 6 ♀ and 24 pupæ bred during March and April from ova found at 300 ft. on *Gomphocarpus physocarpus* E. Mey. Also B.M., 2 ♂, 1 ♀.

### Nymphalidæ.

*Pyrameis itea* Fabr. (2).

*Hypolimnna bolina* L. (2). Recorded as *Diadema bolina* L.

### Lycænidæ.

\**Zizera labradus* Godart, ? subsp. nov. 6 ♂, 2. ii., 150 ft., flying among grasses on "Rocky Point Reserve." Also B.M., one specimen labelled "*phæbe* Murray" *sed quære*.

### Pieridæ.

*Anaphæis java* Sparr. (2). Recorded as *Pieris java* Sparr., but could hardly be typical *java*. B.M. has 1 ♂ and 3 ♀ of subsp. *peristhene* Bdv. from this island.

\**Cepora perimale perimale* Don. (3) and (6). 5 ♂, 2. ii., 150 ft. in "Rocky Point Reserve"; 1 ♂, 20. ii., 300 ft., in "Pine Avenue," and 1 ♂, 4. iii., 150 ft., among shrubs, all more or less worn. Recorded by Olliff (3) as *Belenois perimale* Don. and by Waterhouse and Lyell (6) as *Huphina perimale* Don.

This species was originally described and figured by Donovan (33) from a female specimen, but no exact locality was given, though he purported to be dealing with Australian insects only. As to this, Waterhouse and

Lyell (6) remark : "The butterfly there figured is not Australian. Previous writers have supposed that it came from New Caledonia, but we have specimens from Norfolk Island agreeing exactly with Donovan's figure. As Donovan described other Norfolk Island butterflies as Australian, the origin of *perimale* can no longer be doubted." Olliff (3) had recorded it from Norfolk Island in 1889. The present collection contains seven specimens of the male of this species, and although all are more or less worn, it seems worth while to give a short description, as they are, presumably, of the typical subspecies and appear to differ somewhat from the males of other subspecies.

*Description of Male.*—*Above* : Forewing white with slight creamy tinge ; costa narrowly (usually to cell as far as base of 10 and then to 10), and apex and termen broadly and irregularly, brown-black ; the inner edge of the terminal brown-black area varying somewhat in shape and position, but usually extending from the costa, at about  $7/12$ ths, to the termen just before the tornus, not sharply outlined owing to the admixture, towards the edge, of a varying quantity of white scales amongst the black, and wavy. Base, and basal portion of 9, dusted brown-black. An incomplete series of irregular subterminal, oval or shield-shaped spots, the latter having the apices pointing towards the termen. Hindwing white ; termen very narrowly brown-black ; base dusted brown-black, the brown-black (which often looks quite grey owing to the intermingled white scaling) projecting about, or more than, half way to the tornus, especially between 1 and 2.

*Beneath* : Forewing white, with greenish tinge in cell ; costa, apex and termen grey-brown, the grey-brown area corresponding to the brown-black area of the upper surface ; apex suffused also with pale red-brown ; an incomplete series of obscure and irregular subterminal white spots ; base strongly dusted golden-yellow. Hindwing pale yellow-brown ; an irregular band or series of more or less connected spots very roughly following the line of the termen at about  $7/9$ ths, grey-brown ; this irregular band evidently represents the inner edge of the brown terminal areas of other subspecies such as *scyllara* Macleay and *latilimbata* Butler.

## Papilionidæ.

\**Papilio amphiaras* Feld. (*ilioneus* Don.) (2). 1 ♂, 4. iii., 150 ft., amongst shrubs. Also B.M., 2 ♂ and 2 ♀ of subsp. *ilioneus* Don.

*Papilio macleayanus* Leech (8).

## HETEROCERA.

## Arctiidæ.

*Utetheisa pulchella* L. (2). Recorded as *Deiopea pulchella* L. Probably *U. pulchelloides* Hmps. (teste W. H. T. Tams).

*Nesiotica cladara* Turner (4).

## Agrotidæ.

## AGROTINÆ.

\**Agrotis ipsilon* Hufn. (4). 7 ♂, Feb., March, April, May, Sept. (two) and Oct.; 9 ♀, March (two), April, May, June, Sept. (three) and Oct.; all at 250-300 ft. Recorded as *A. ypsilon* Rott.

## HADENINÆ.

*Leucania loreyi* Dup. (4). Recorded as *Cirphis loreyi* Dup.

\**Leucania unipuncta* Haw. (4). 1 ♂, 18. viii., 900 ft., among dry leaves on Mt. Pitt; 1 ♂, 25. ix., 300 ft., in house. Recorded as *Cirphis unipuncta* Haw.

## ACRONICTINÆ.

*Prodenia litura* Fab. (4).

\**Spodoptera nubes* Guen. 1 ♂, 2. ii., 300 ft., from grass in "Rocky Point Reserve"; 1 ♂, 1. vi., 300 ft., at light in house.

*Perigea illecta* Wlk. (5). Recorded as *P. capensis* Gn., but see Tams (7, p. 201).

\**Proxenus tenuis* Butl. (4). 1 ♂, 18. ix., 300 ft., at light in house; 1 ♀, 7. v., 300 ft., in house.

\**Elydna thoracica* Moore. 1 ♀, 2. x., 300 ft., at light in house.

CATOCAINÆ.

*Achæa melicerta* Dr. (2).

\**Mocis frugalis* Fab. 1 ♂, 3. ii., 300 ft., in house ; 1 ♀, 2. ii., 300 ft., from long grass in "Rocky Point Reserve" ; 1 ♀, 27. iii., 300 ft., in house.

PLUSIINÆ.

\**Plusia chalcites* Esp. 1 ♂ and pupa and 1 ♀, bred from green larvæ found on lettuce in mid-June, at 300 ft. ; 1 ♂, 14. vii., 250 ft., at light in house ; 1 ♀, 20. vii., 250 ft., in garden ; 1 ♀, 1. x., 300 ft., in house.

OPHIDERINÆ.

\**Dasypodia selenophera* Guen. 1 ♂, 2 ♀, late March, 300 ft., at light in house.

\**Rivula* sp. 1 ♂, 12. vi., 950 ft., on leaf of *Rhopalostylis bauri* H. Wendl. & D.

HYPENINÆ.

*Hydrillodes lentalis* Guen. (4).

\**Hydrillodes* sp. 1 ♂, 7. ix., 300 ft., at light in house. In poor condition, but apparently not *H. lentalis* Guen. :

*Hypena masuralis* Guen. (= *ferriscitalis* Wlk.) (4).

\**Hypena* sp. 1 ♂, 12. ii. ; 1 ♂, 2. vi. and 1 ♀, 26. ix., all at 300 ft. in house. These may be a form of the last species.

Sphingidæ.

*Herse convolvuli* L. (2) and (4). Recorded by Olliff (2) as *Protoparce convolvuli* L. var. *distans* Butl.

Geometridæ.

HEMITHIINÆ.

\**Agathia distributa* T. P. Lucas. 2 ♀, 8. iii., 350 ft., at light. Probably a new subspecies (teste L. B. Prout).

STERRHINÆ.

\**Scopula rubraria* Dbld. (1), (2) and (4). 1 ♂, 1 ♀, 2. ii., 300 ft., from long grass at "Rocky Point Reserve" ; 5 ♂, 2 ♀, 3. v., 300 ft., at light in house ; 2 ♂, 4 ♀, 14. vii., 250 ft., at light in house. Recorded as *Acidalia rubraria* Dbld.



*Scopula hypochra* Meyr. (4). Recorded as *Acidalia hypochra* Meyr.

\**Scopula*, sp. n. ? 2 ♀, 26. ix., 300 ft., at light in house. This appears not to be the last-mentioned species.

#### LARENTIINÆ.

*Chloroclystis laticostata* Wlk. (4).

\**Xanthorhoë sodaliata* Wlk. (4). 2 ♀, 25 & 27. ix., 300 ft., in house. Possibly a new subspecies (*teste* L. B. Prout).

#### GEOMETRINÆ.

*Oleora idiocrossa* Turner (5).

#### PYRALIDÆ.

##### CRAMBINÆ.

*Crambus cuneiferellus* Wlk. (1) and (4).

\**Crambus* sp. A number of specimens, all badly worn, of both sexes, flying over a creek or at light in the garden, 29 April and 1 May, or at light in the house on 14 July and 1 Oct.; all at 250–300 ft. This may be the last-mentioned species, but I think not. There are no specimens available for comparison at present, and these are too worn for determination by description alone.

#### PHYCITINÆ.

*Crocodypora cinigerella* Wlk. (4).

#### ENDOTRICHINÆ.

*Trichophyesis neophyla* Meyr. (1) and *T. cretacea* Bull. (4). See my note on these two species in the early part of this paper.

*Endotricha dyschroa* Turner (5).

#### SCOPARIINÆ.

*Scoparia tritocirrho* Turner (4) and (5).

\**Scoparia* sp. 3 ♀, Sept., 300 ft., at light in house. Judging from the description only, these are not the same as the last-mentioned species.

PYRAUSTINÆ.

\**Ercta ornatalis* Dup. 1 ♂, 2. ii., 300 ft., from long grass on "Rocky Point Reserve."

*Diasemia grammalis* Dbld. (1). From Meyrick's own remarks at p. 239 when recording this species, it is almost certainly an error for the next species.

\**Diasemia delosticha* Turner (5). 2 ♀, 12. iv.; 1 ♂, 3. v.; 4 ♂, 2 ♀, 2. vi.; 1 ♀, 21. vi.; 2 ♂, 8 ♀, 14. vii.; 1 ♂, 16. ix.; and 1 ♀, 1. x. All at 250-300 ft. at light in house or garden.

\**Hymenia recurvalis* Fab. (4). 2 ♀, 12 & 18. iv., 300 ft., at light in garden; 1 ♀, 7. v., 20 ft., bred from green larva found on *Tetragonia expansa* Murr. Recorded as *H. fascialis* Cram.

*Godara comalis* Guen. (1). ? = *Crocidolomia binotalis* Zeller.

*Acharana licarsisalis* Wlk. (4).

\**Margaronia* sp. 1 ♀, 15. i., in house; ♂ and ♀ taken in cop. at light in house 20. iii.; all at 300 ft.

Tortricidæ.

TORTRICINÆ.

*Capua aridella* Turner (5).

*Tortrix* sp. (4) and (5).

\**Tortrix* sp. 1 very worn ♂, 24. vi., 250 ft., on a rock in damp gully. Possibly the same species as the 2 ♀ recorded by Turner as not determinable.

*Schœnotenes capnosema* Turner (5).

EUCOSMINÆ

*Acroclita macroma* Turner (5).

\**Crociosema plebeiana* Zell. (4). 1 worn ♂ 29. vi. 250 ft., beaten from bushes; 1 worn ♀, 12. iv., 300 ft., at light in garden. Recorded as *Eucosma plebeiana* Zell.

*Polychrosis botrana* Schiff. (4).

*Argyroploce illepida* Butl. (4).

Tineidæ.

GLEBCHINÆ

*Brachmia* sp. (5). Said to be closely allied to *arotræa* Meyr. from Ceylon and India.

*COSMOPTERYGINÆ.*

\**Cosmopteryx mimetis* Meyr.? One specimen without body or head, 29. iv., 250 ft., flying over creek in wet weather. ? This species or introduced.

*ELACHISTINÆ.*

\**Elachista archæonoma* Meyr.? 1 ♂, 29. vii., 250 ft., beaten from bushes.

*PLUTELLINÆ.*

\**Plutella maculipennis* Curt. 1 ♀, 15. iv., at light in garden; 5 specimens bred 1. vii. from green larvæ found on cauliflowers; and 1 ♂, 5. vii. on *Maranta arundinacia* L.

*LYONETINÆ.*

?\**Opoyona omascopa* Meyr. (4). 1 ♂, 1 ♀, 15. iv., 300 ft., at light in garden; 1 ♀, 14. vii., 250 ft., at light in house. Recorded as *Hieroxestis omascopa* Meyr.

Mrs. McComish's specimens are referred to this species with some doubt.

*TINEINÆ.*

\**Monopis vivipara* Scott (= *meliorella* Wlk.). 1 ♀, 21. vi., in house.

*Tinea capnitis* Turner (5).

\**Tinea* sp. Ten cocoons and empty pupæ found 2. v., hanging under shelf in shed, 300 ft.

\*Also nine very worn Tineidæ quite indeterminable.

# BIOLOGICAL NOTES ON SOME OF THE SPECIES CAPTURED BY MRS. MCCOMISH.

In the above list I have given fairly full records for the various species, since they serve to show how restricted the collecting was—mostly in and around the house, with a few trips further afield, such as to Mt. Pitt and "Rocky Point Reserve."

The records also furnish a certain amount of information as to life-histories and habits which may be of some interest, and in this connection the fact that over almost the whole period of collecting, from 15. i. 39 (*Margaronia* sp., ♀) to 2. x. 39 (several species), observation was maintained in one area, while probably a disadvantage so far as the total number of species recorded is concerned, gives a better idea of incidence in the case of such species as have been taken. The following will serve as examples :—

*Danaus menippe*. ♂♂ taken 2. ii. 39. Imagines bred March and April 1939.

*Agrostis ipsilon*. Taken during every month over the whole period of observation, except in January, July and August.

*Spodoptera nubes*. 2. ii. 39 and 1. vi. 39.

*Proxenus tenuis*. 7. v. 39 and 18. ix. 39.

*Plusia chalcites*. Larvæ mid-June 1939. Imagines July 1939 and again in October 1939.

*Hypania* sp. 12. ii. 39, 2. vi. 39 and 26. ix. 39.

*Scopula rubraria*. Both sexes. 2. ii. 39, 3. v. 39 and 14. vii. 39.

*Crambus* sp. April–May, July and October 1939.

*Diasemia delosticha*. ♀♀, 12. iv. 39; ♂, 3. v. 39; both sexes in June and July 1939: 1♂, 16. ix. 39 and 1♀, 1. x. 39.

*Plutella maculipennis*. April and July 1939.

*Opogona oмасcopa*? April and July 1939.

Some of the above species may be, and probably are, continuously brooded in the island, but the records indicate that others have two, or at most three, definite broods during the period under review.

Most of the remaining species taken by Mrs. McComish appear to have occurred during one comparatively short period only in each case.

The following table will give some idea of the distribution of the species recorded as occurring in Norfolk Island. The British Museum has been utilized for localities in some cases. Letters in brackets, thus (a), before the name of a species refer to the notes at the end of this table.

[illegible]

Norfolk Island.	Lord Howe Island.	Kermadec Islands.	New Caledonia.	Loyalty Islands.	Fiji.	Tonga.	New Hebrides.	Australia (Q. Queensland; T. Tasmania, etc.).	New Zealand.	Malay Archipelago.	Cosmopolitan.
<i>Crocodydopora cinigerella</i>	..	..	..	..	..	..	..	x	x		
<i>Trichophyaetis neophylla</i>	..	..	..	..	..	..	..	E. Aust.			
" <i>cretacea</i>	..	..	..	..	..	..	..	x			
<i>Endotricha dyschroa</i> .											
<i>Scoparia tritocirra</i> .											
" sp.											
(l) <i>Ercia ornatalis</i> .....	..	..	..	..	x	x	x	?			
<i>Diasemia graminalis</i> ..	..	..	..	..	..	..	..	..	x		
" <i>delosticha</i> .											
(l) <i>Hymenia recurvalis</i> ...	..	x	..	..	x	..	x	N.S.W.	x		
<i>Godara comalis</i> .....	..	..	..	..	..	..	..	x			
<i>Acharana licarnisalis</i> ..	..	..	..	..	..	..	..	x			
<i>Margaronia</i> sp.											
<i>Capua aridella</i> .....	x										
<i>Tortrix</i> spp.											
<i>Schænotenes capnosema</i>	x										
<i>Acroclita macrona</i> ...	x										
(m) <i>Crocidosema plebeiana</i> .	..	..	..	..	x	x	..	x	x	..	x
<i>Polychronis botrana</i> ...	..	..	..	..	..	..	..	x	..	..	x
(n) <i>Argyroproctis illepada</i> ...	..	..	..	..	x	..	x	x			
<i>Brachmia</i> sp.											
<i>Cosmopteryx mimetis</i> .									x		
<i>Elachista archæonoma</i>	..	..	..	..	..	..	..	..	x		
<i>Phutella maculipennis</i> ..	..	..	..	..	..	..	..	..	..	..	x
(o) <i>Opogona onoscopa</i> ...	..	..	..	..	..	..	..	E. Aust.	x		
<i>Monopis vivipara</i> .....	..	..	..	..	..	..	..	Q.; V.; and N.S.W.	x		
(p) <i>Tinea caputis</i> and sp.											

(a) Ranges from India, east to Celebes.

(b) Also occurs in N., S. and C. America and W. Indian Islands.

(c) A very widespread species with many subspecies, ranging from Madagascar eastwards in the warmer regions.

(d) Distribution doubtful owing to confusion of species in records.

(e) Also recorded from many places in India, Asia, Africa, New Guinea, etc.

(f) Also in India, Philippines, New Guinea, etc.

(g) Also in Africa, India, Borneo, etc.

(h) Almost cosmopolitan within climatic range.

(i) Habitat, Eastern Hemisphere except higher altitudes.

(j) Also in New Guinea and Admiralty Islands.

(k) Also in Papua.

(l) Very widespread in tropical and sub-tropical regions.

(m) Original home is said to have been probably S. America.

(n) Many other localities have been reported, but ? same species.

(o) Also in S. Africa, Rodrigues and Mauritius.

(p) Genus cosmopolitan

## SPECIES OF ECONOMIC IMPORTANCE.

Of the above-mentioned species, 21 have been recorded as pests of economic importance, i. e. :—

*Danaus menippe*, on "Uganda Hemp" (*Asclepias semi-lunata*).

*Zizera labradus*, on Lucerne.

*Utetheisa pulchella* on "Sann Hemp" (*Crotalaria junica* and *C. striata*) in India; also recorded as feeding on Sugar-cane, Cinchona, etc. Some of these records may refer to *U. pulchelloides*: see Tams (7), p. 176.

*Agrotis ipsilon*, on Tobacco, Potato, Cruciferæ, Cotton, etc.

*Leucania loreyi*, on Rice, Sugar-cane and Maize.

*Leucania unipuncta*, on Sugar-cane, Maize, Millet, Oats, Rice, Wheat, etc.

*Prodenia litura*, on Sugar-cane, Maize, Cabbage, Potato, Rice, and many other plants.

*Perigea illecta*, on Acanthaceæ, etc.

*Acæa melicerta*, on Castor-oil tree.

*Mocis frugalis*, on Sugar-cane, Sorghum, Millet, Rice.

*Plusia chalcites*, on Tobacco, Corn, Maize, Potato, Tomato, etc.

*Herse convolvuli*, on Sweet Potato and "Til" (*Sesamum indicum*).

*Chloroclystis laticostata*, on Cherry.

*Erota ornatalis*, on *Ipomæa triloba*.

*Hymenia recurvalis*, as *H. fascialis* Cram.; "Hawaiian Beet Webworm," as a pest of Beet, Maize, Cucurbitaceæ and *Amaranthus*.

*Godara comalis*, on Horse-radish and Turnip. (Note. Hampson treats this as a synonym of *Crocidolomia binotalis* Zell., an African species which has been recorded as a pest of Cabbage.)

*Crocidosema plebeiana*, on *Hibiscus*, Cotton and other Malvaceous plants.

*Polychrosis botrana*, on Vine.

*Argyroploce illepidæ*, on *Cassia*, *Sesbania*, Orange, etc.

*Plutella maculipennis*, on Cruciferæ.

*Opogona omoscopa*, on "Pigeon Peas" (*Cajanus indicus*).

In addition to the above, *Spodoptera nubes*, *Elydna thoracica*, *Scópula rubraria*, *Scópula* sp., *Xanthorhœ sodaliata*, *Crambus cuneiferellus*, *Crambus* sp., *Margaronia* sp., *Capua aridella*, *Tortrix* spp., *Elachista archæzónoma*,

and the *Tinea* spp. are all allied to species which have been recorded as pests of various plants and substances at one time or another.

Turner (5, p. 288) mentions three species included in his list, *Crocidosema* (or, as he has it, *Eucosma*) *plebeiana*, *Polychrosis botrana* and *Opogona* (or again, as he has it, *Hieroxestis*) *omoscopa*; which have been artificially introduced, and says that "possibly others" should be included in this category. The above list of species of economic importance includes no less than 12 out of the 33 species listed by Turner (4 and 5), while six more are included amongst those related to recorded pests. Of other species, previously recorded by Meyrick (1) and Olliff (2), three are included in the above "economic" list, while of the 22 species now recorded for the first time (so far as is known) six appear in the "economic" list and eight are amongst those related to recorded pests.

From this it would appear highly probable that a much larger percentage of species than that suggested by Turner is due to artificial introduction.

### TRICHOPTERA.

Mrs. McComish's collection contained but two Trichoptera, and these proved to be males belonging to the family Leptoceridæ, subfamily Triplectidinae. The species has been determined by Mr. M. E. Mosely as *Triplectides cephalotes* Walker. This is a New Zealand species and a new record for this locality. Tillyard (31) also records for the island "*Notanatolica magna* Walker: . . . . a single female in good preservation." "A very common Australian species." As to this, Mr. Mosely states that the ♀ of this species (now known as *Triplectides magna* Walker) is indistinguishable from that of *T. cephalotes*, and that it was probably a mistaken identification for the present species, which has been determined upon examination of the ♂ genitalia.

### HYMENOPTERA.

In this order Mrs. McComish's collection contained a considerable number (some 370 specimens) of Formicoidea and 57 specimens belonging to other families. The Formicoidea have been dealt with in a separate paper by



Mr. H. St. J. K. Donisthorpe (8 a), and reference may also be made to papers by W. M. Wheeler (28) and (28 a) for previous records, etc., but it has proved to be impossible to deal adequately, under present conditions, with the other groups. Although, therefore, a few of her species have been identified and generic names obtained for a certain number of others, many, unfortunately, have had to be left as determined to the appropriate family or subfamily only.

The following is the complete list for the island so far as I have been able to ascertain, those species taken by Mrs. McComish being indicated with a \* and endemic species by a †.

## ICHNEUMONIDEA.

### Ichneumonidæ.

#### PIMPLINÆ.

\**Xanthopimpla* sp. 1 ♀.

\**Ecthromorpha* sp. 1 ♀.

#### OPHIOINÆ.

\**Ophion*. 2 spp. 3 ♂ and 6 ♂, 10 ♀ respectively.

#### CRYPTINÆ.

\*? 4 spp. 2 ♂ and 3 ♀.

#### CAMPOPLEGINÆ.

\*? sp. 1 ♂, 1 ♀.

### Braconidæ.

#### AGATHINÆ.

\**Microdus* sp. 2 ♂, 1 ♀.

#### MICROGASTERINÆ.

\**Apanteles* sp. 1 ♂.

#### APHIDIINÆ.

\**Aphidius* spp. 2 ex. (damaged).

## CHALCIDOIDEA.

### Chalcididæ.

*Chalcis* sp. near *C. victoris* Girault and *C. atrata* Kirby (38).

**Cleonymidæ.**

*Aplatygerrhus imperialis* Dodd (38).

**Encyrtidæ.**

**ENCYRTINÆ.**

\**Metaphycus* sp. 6 ♂, 7 ♀, from two specimens of *Saissetia coffeæ* (Wlk.) on *Gomphocarpus physocarpus* (E. Mey.) and very near, if not actually, *Metaphycus lounsburyi* (Howard) (teste F. Laing).

**APHELININÆ.**

*Aphelinus* sp. Closely related to *A. dies*, *A. pax* and *A. nox*, all Girault species (38).

**ECTROMINÆ.**

*Anusia viridiflava* Dodd. (38).

**Miscogasteridæ.**

**LELAPINÆ.**

*Lelaps truncatipennis* Dodd (38).

**Pteromalidæ.**

\*? 2 spp. 1 ♂, 1 ♀ (damaged).

**ASAPHINÆ.**

*Ophelosia leai* Dodd (38) and *Tomocera californica* Howard (38).

**SPHEGIGASTERINÆ.**

*Polycystomyia benefica* Dodd (38).

**ROPTRO CERINÆ.**

*Pseudanognmus fasciipennis* Dodd (38).

**Eulophidæ.**

**OPHELININÆ.**

*Sympiesomorpha norfolcensis* Dodd (38).

**PROCTOTRUPOIDEA.**

**Ceraphronidæ.**

*Ceraphron* sp. (38).

## Scellionidæ.

*Trimorus norfolcensis* Dodd (38), *T. leai* Dodd (38), and *Hadrontus* sp. closely related to *H. parvipennis* Dodd (38).

## Diapriidæ.

*Tetramopria plana* Dodd (38), *Phænopria norfolcensis* Dodd (38), and *Spilomicrus* sp. very closely allied to *S. gracilis* Dodd (and ? that species) (38).

As to the Chaloidoidea, Dodd (38) remarks that they "show very close relationship to Australian forms," but with regard to the Proctotrupoidea he says that they "are, on the whole, widely separated from Australian relations; the presence of wingless or aborted-winged forms is a typically insular characteristic."

## FORMICOIDEA.

## Formicidæ.

## Ponerinæ.

†*Ponera læ* Forel, subsp. *oculata* Wheeler (28 a), and †*P. mina* Wheeler (28 a).

\*†*Amblyopone australis* Er., subsp. *cephalotes* Smith, var. *norfolkensis* Wheeler (28) and (8 a). 28 ♂♂, "under decayed palm-leaves, Mt. Pitt," 900 ft., 18. vii. 39.

## MYRMECINÆ.

\*†*Pheidole* (*Pheidole*) *ampla* Forel, subsp. *norfolkensis* Wheeler (28 a) and (8 a). 19 ♀♀, "dry season, under dry cow-dung," 300 ft., 3. ii. 39; 11 ♀♀, 20 ♂♂, "in a run at Kingston," 10 ft., 29. v. 39; 6 ♂♂, "dry season, on orchid flowers on Mt. Pitt," 1000 ft., 28. i. 39; and very many ♂♂ and winged ♀♀ on wing and "swarming," v. and vi. 39.

*Monomorium* (*Lampromyrme*) *læve* Mayr, subsp. *fraterculus* Santschi (28 a); also recorded from Lord Howe Island and Queensland. "Probably introduced."

\*†*Monomorium* (*Notomyrme*) *sanguinolentum* Wheeler (28 a) and (8 a). 12 ♂♂, "dry season, under decayed wood," 300 ft., 7. iii. 39; and 15 ♂♂, "on lower leaves of *Solanum auriculatum* Ait.," 30 ft., 29. iv. 39.

\*†*Oligomyrme* *manni* Donisthorpe, var. *norfolkensis* Donisthorpe (8 a). 1 winged ♀ and about 40 ♂♂; ♂ and ♀ types in Brit. Mus.; "swarming," 300 ft., 28. vii. 39.

†*Cardiocondyla nuda* Mayr, subsp. *nereis* Wheeler (28 a).  
*Tetramorium guineense* Fab. (28 a). Also recorded  
 from Lord Howe Island.

†*Tetramorium antipodium* Wheeler (28 a).

*Strumigenys lœ* Forel (28 a). Also recorded from Lord  
 Howe Island and Tasmania.

#### DOLICHODERINÆ.

†*Iridomyrmex albitarsus* Wheeler (28 a).

#### FORMICINÆ.

*Paratrechina (Nylanderia) vaga* Forel. Also recorded  
 from New Caledonia, Bismarck Archipelago, New Guinea  
 and Juan Fernandez (28 a).

*Paratrechina (Nylanderia) obscura* Mayr. (8 a). 15 ♂♂,  
 "on lower leaves of *Solanum auriculatum* Ait.", 200 ft.,  
 6. v. 39. This was the first record of the species for  
 Norfolk Island. Also known from New Caledonia, New  
 South Wales, Victoria and Queensland.

### VESPOIDEA.

#### Bethylidæ.

*Sclerodermus norfolcensis* Dodd (38, at p. 184). 1  
 apterous ♀, 1 macropterous ♀. Taken under decayed  
 leaves on Mt. Pitt, 1,000 ft., 12. vi. 39. "As noted by  
 Dodd, the species does not really belong to *Sclerodermus*,  
 but this, and the allied genera, would have to be revised  
 before a new genus could be erected for *S. norfolcensis*"  
 (per Dr. O. W. Richards, *in litt.*).

*Sierola* sp. 1 ♀, "Beaten from bushes" 250 ft.,  
 25. vi. 39. "Also noted by Dodd (*t. c.* p. 186). Very  
 many spp. are known from Australia" (per Dr. O. W.  
 Richards, *in litt.*).

### SPHECOIDEA.

#### Sphegidæ.

*Pison spinolæ* Shuck. 1 ♂, 3 ♀, "Known from Aus-  
 tralia and New Zealand" (per Dr. O. W. Richards, *in litt.*).

Except as indicated, there are no records of the hosts  
 of parasitic species, as nearly all Mrs. McComish's speci-  
 mens were either beaten from bushes or caught flying.

## SPECIES OF ECONOMIC IMPORTANCE.

*Sclerodermus norfolcensis* (Dodd). Species of this genus are beneficial and mostly parasitic on wood-boring Coleoptera.

*Metaphycus* sp. *M. lounsburyi* (Howard) is a well-known beneficial parasite and control of *Saissetia oleæ* (Bernard) ("Black Scale"), and all species of the genus are parasitic on Coccids of the same type.

*Tomocera californica* (Howard). Beneficial as a parasite of various Coccids, including *Saissetia coffeæ* (Wlk.) [= *S. hemispherica* (Targ.)] and *S. oleæ*.

Apart from these, the majority of the Hymenoptera (other than the Formicoidea) noted from the island are parasitic upon Lepidopterous larvæ, or on plant-bugs of one kind or another, and may therefore be regarded as beneficial rather than otherwise.

## COLEOPTERA.

Mrs. McComish's material included 236 specimens of Coleoptera distributed amongst 18 families, some 31 genera and 38 or more species. Quite a number of species have been previously recorded from this island by various workers, but since Olliff (2) wrote in 1888 no attempt seems to have been made to bring the records together in any faunistic paper.

The following is a list, with notes on distribution, etc., of recorded species, those obtained by Mrs. McComish being indicated by a \*. All dates are for 1939.

## Carabidæ.

## HARPALINÆ.

\**Agonum* sp. 2 ♀♀ under wet decayed palm-leaves, Mt. Pitt, 900 ft., 12. vi. A widespread genus, in *sens. lat.*

\**Dicrochile* sp. (probably sp. n.). 1 ♀ under decayed wood on Mt. Pitt, 950 ft., 4. viii. This is a large blackish species, some 18 mm. in length, and, judging from descriptions alone, appears to be new. Genus occurs in Australia, Tasmania, New Zealand and New Caledonia.

\**Chlœnius ophonoides* Fairm. (as *peregrinus* Laf. = *peregrinus* Chaud.) (2). 1 ♀ under cow-dung, 300 ft., 3. ii.; 1 ♀ under decayed vegetation, Mt. Pitt, 900 ft., 1939.

Also recorded from Lord Howe Island, New Caledonia, New Hebrides, Queensland and New South Wales.

*Diaphoromerus iridipennis* Chaud. (as *iripennis* Ch.) (2). Also recorded from Lord Howe Island and Queensland.

### Gyrinidæ.

\**Aulonogyrus* sp.? 39 examples in ripples of small creek, 200 ft., 29. iv. This is mainly an African genus, but has representatives in New Caledonia, Australia, Tasmania, etc. Mrs. McComish's specimens may belong to a new genus and species (*teste* J. Balfour-Browne).

### Staphyllinidæ.

#### OXYTELINÆ.

\**Omalium* (or ? *Phlæonomus*) sp. 1 ex. beaten from bushes, 250 ft., 29. vi., and 1 ex. in house, 300 ft., 2. x. Cosmopolitan genera.

#### PÆDRINÆ.

*Astenus guttula* (-us Lea 1923) Fauv. (12). Also recorded from Lord Howe Island, New South Wales, Victoria, S. and W. Australia and Tasmania.

*Medon debilicornis* Woll. (12). "Introduced." Nearly cosmopolitan.

#### STAPHYLININÆ.

*Metoponcus rufulus* Broun, var. *norfolcensis* Lea (14). Also recorded from New Zealand.

*Leptacinus opacipennis* Lea (14). Cosmopolitan genus.

*Philonthus longicornis* Steph. (14). "Introduced." Cosmopolitan.

*Creophilus erythrocephalus* F. (2). Also recorded from Tahiti, Chile, Tonga, New Caledonia, Australia and Tasmania.

#### ALBOCHARINÆ.

\**Atheta*, 2 spp. 4 ex. (3 in house), 300 ft., 28. viii., 2. ix., 29. ix., and 1. x.

### Corylophidæ (=Orthoperidæ).

\**Sericoderus* sp. 8 ex. on drying botanical specimens, 250 ft., 2. vii. Cosmopolitan genus with several Australian and New Zealand species.

**Ptiliidæ (=Trichopterygidæ).**

*Acrotrichis* (as *Trichopteryx*) *norfolkensis* Deane (26).  
An almost cosmopolitan genus.

**Histeridæ.**

*Acritus norfolcensis* Lea (21). A very widespread genus  
in Europe, E. Asia, America, Australia, etc.

**Temnochilidæ (=Trogositidæ).**

*Leperina turbata* Pasc. (2). Also recorded from  
Australia. Genus recorded from E. Asia, New Guinea,  
New Caledonia, Australia and New Zealand.

**Nitidulidæ.**

*Lasiodactylus calvus* Oll. (2). A widespread genus but  
mainly African.

\**Epuræa* (or near) sp. 1 ex. at light in house, 300 ft.,  
8. vi. Cosmopolitan genus.

**Cucujidæ.**

*Læmophloeus norfolcensis* Lea (18). Cosmopolitan  
genus.

\**Cryptamorpha desjardinsi* Guér. 2 ex. in house,  
300 ft., 21. vi. and 2. x. Cosmopolitan species carried by  
commerce.

**Coccinellidæ.****COCCINELLINÆ.**

*Rhizobius* (as *Rhizobius*) *erythrogaster* Lea (18). Known  
from Norfolk Island only. Apparently mainly an  
Australian genus, *sed quære*.

*Scymnus obscuripennis* Lea (18). Known from Norfolk  
Island only. Cosmopolitan genus.

*Scymnus pumilio* Ws. (as *flavifrons* Blackb.), var.  
*norfolcensis* Lea (18). Typical form recorded from many  
parts of Australia and Tasmania.

\**Scymnus*, 4 spp. 15 ex. (2 spp.) and 1 larva, beaten  
from Orange-trees and *Cordyline baueri* Hook., 250 ft.,  
25. vi.; 1 ex. on leaves of *Baloghia lucida* Endl., 250 ft.,  
22. iv.; 1 larva on drying botanical specimens, 250 ft.,  
2. vii.

\**Chilomenes polynesia* Crotch (?) and var. 2 ex. on  
leaves of Red Guava, 300 ft., 16. iii.; ?=*duodecim-*

*punctata* Fauv. from New Caledonia and Fiji Islands. A scattered genus in the Oriental and Pacific regions.

### Hydrophilidæ.

\**Cercyon* sp. 1 ex. in house, 300 ft., 6. x. Almost cosmopolitan genus.

### Bostrychidæ.

*Xylion* (as *Rhizopertha*) sp., allied to *X. (R.) collaris* Er. (2). Genus recorded from Africa, India, Java, E. and S.E. Australia, Tasmania.

### Anobiidæ.

#### ANOBIINÆ.

*Pronus marmoratus* Lea (13). Genus also recorded from W. Australia, Pearson Island and Lord Howe Island.

#### DORCATOMINÆ.

*Calymnaderus pulverulens* Lea (13). An almost wholly American genus.

*Dorcatoma norfolcensis* Lea (13). A widespread genus.

*Dorcatoma rhizobioides* Lea (13). A widespread genus.

### Elateridæ.

#### CONODERINÆ.

*Glyphochilus basicollis* Lea (18). An Australian and Tasmanian genus with three other species in Lord Howe Island.

\*? *Conoderus* (as *Monocrepidius*) *striatus* Macleay (2). 2 ex., 300 ft., 27. iii., and in house 24. ix. A world-wide genus with some 150 Australian and Polynesian and four New Zealand species.

*Conoderus* sp. Closely allied to last (2).

#### LUDIINÆ.

*Ochosternus norfolcensis* Lea (18). Genus recorded from New Caledonia, Lord Howe Island and New Zealand.

*Dicteniophorus ramifer* Esch. (2). Australian genus.

### Eucnemidæ.

*Formus norfolcensis* Lea (17 and 18). A genus of predominantly tropical distribution



**Buprestidæ.**

*Melobasis purpurascens* F. (2). Also recorded from Malay Archipelago. Predominantly Australian genus.

**Tenebrionidæ.**

*Gonocephalum* (as *Hopatum*) *insulanum* Oll. (2). A nearly world-wide genus with species in Australia, Lord Howe Island, New Caledonia, New Hebrides, Java, Borneo, New Guinea, etc.

\**Gnathocerus cornutus* F. 1 ♀ in dead wood of *Lagunaria patersoni* G. Don., 200 ft., 4. v. Cosmopolitan: carried by commerce.

*Mesotretis fumata* Lea (18). Genus originally described from Australia.

*Mesotretis glabra* Lea (18).

*Brachycilibe araucariæ* Lea (18). Genus also recorded from Lord Howe Island and Tasmania.

*Araucaricola ebenina* Lea (18). Other species now known from S. Pacific.

\**Lorelus* sp. 2 ex. in house, 300 ft., 24. ix. and 2. x. Genus recorded from New Zealand, New Caledonia, West Indies, Central America, Brazil, Indo-China and Caroline Islands.

\**Metisopus purpureipennis* Bates (2). 10 ex., 300 ft., 16. ii.; 13 ex., 900 ft., 18. iv.; 8 ex. on Mt. Pitt, 900 ft., 12. vi.; all on dead wood. Genus not known elsewhere.

**Euglenidæ (=Xylophilidæ=Hylophilidæ).**

*Euglendeles* (as *Xylophilus*) *norfolcensis* Lea (25). Cosmopolitan genus.

**Anthicidæ.**

\**Anthicus strictus* Er. 1 ex. flying over creek in wet weather, 250 ft., 29. iv.; 1 ex. beaten from bushes, 250 ft., 29. vi.; 1 ex. in house, 300 ft., 1. ix. Also recorded from Australia and Tasmania. Cosmopolitan genus.

**Mordellidæ.**

*Mordella norfolcensis* Lea (25). Cosmopolitan genus.

**Lucanidæ.**

\**Lamprima seneca* F. (2). 2 ♂♂ on ground in "Rocky Point Reserve," 150 ft., 2. ii.; 1 ♂, 1 ♀ on track in

"Pine Avenue," 300 ft., 22. iii.; 1 ♂ (no details), 500 ft., 21. iv. Genus also recorded from Australia (several species), Tasmania and Lord Howe Island.

### Scarabæidæ.

#### APHODIINÆ.

\**Atsenius* sp. 2 ex. under dry cow-dung, 300 ft., 3. ii.; 4 ex. under decayed wood, 300 ft., 16. iii. Genus mainly South American, but with a number of species in Australia, New Guinea, etc.

#### DYNASTINÆ.

\**Pimelopus* (as *Chiropatys*) *lissus* Oll. (2). 2 ♀♀ (no details), 350 ft., 18. i., and 1 ♂ (no details), 300 ft., 1. iv. Genus so far recorded from Australia, Tasmania, New Caledonia, New Guinea and Central America.

This species was placed by Olliff (2, pp. 1004-5) in the genus *Cheiroplatys* (as *Chiropatys*), though with some doubt. The specimens collected by Mrs. McComish appear to agree in every respect with Olliff's description of his species, the single male differing from the two females in its smaller size (19 mm. as against 22 mm.) and in the shape of the last ventral segment (slightly excavated at the termen instead of ending in a blunt point) only. Mr. G. J. Arrow is of opinion that they should undoubtedly be placed in the genus *Pimelopus*, and that it is extremely unlikely there would be another species belonging to the true *Cheiroplatys* genus in so small and remote an island. In his view it is probable that Olliff really had the two sexes, but overlooked the fact owing to his expecting to find greater and more obvious differences; the dimensions given by him, 18-23 mm., rather suggest this also.

### Curculionidæ.

#### OTIORRHYNCHINÆ.

\**Ocyrama rhyssa* Oll. (2). 1 ♂ on leaves of French bean, 300 ft., 20. v. Genus also recorded from Swan River, W. Australia.

#### EREMNINÆ.

*Mandalotus norfolcensis* Lea (9). Genus also recorded from Lord Howe Island, Queensland, New South Wales, Victoria and Tasmania.

## CYLINDRORHINÆ.

\**Listroderes obliquus* Gyll. 2 ex., 300 ft., under dry cow-dung, 3. ii., and in house, 9. x Also recorded from Australia. A South American genus. Probably introduced.

## CRYPTORRHYNCHINÆ.

*Psepholax pascoei* Oll. (2). Genus recorded from Queensland, New South Wales, New Zealand and New Caledonia.

*Xestocis castaneus* Lea (23). Genus also recorded from Queensland.

*Tyrtæosus imitator* Lea, var. *norfolcensis* Lea (23). An E. Australian species. Genus mainly E. and S.E. Australian and Tasmanian, but reaches New Guinea.

*Decilaus nigrohumeralis* Lea (11). A widespread genus in Australia and Tasmania.

*Tapinocis setosus* Lea (16). Genus also in Lord Howe Island, W. Australia and Tasmania.

*Microcryptorrhynchus norfolcensis* Lea (10), *M. rufimanus* Lea (10) and *M. setosus* Lea (10). Genus recorded from Lord Howe Island, W. Australia, New South Wales, Queensland, Tasmania, Samoa, Fiji, Marquesas Islands and New Caledonia.

*Euthyrhinus mediatundus* F. (2). Also recorded from Lord Howe Island, Australia and Malay Archipelago. Genus in Australia, New Zealand, New Guinea, Singapore, etc.

\**Mitrastethus lateralis* Lea (19). 1 ex. in house, 300 ft., 7. ix. Genus recorded from Australia, New Zealand and New Caledonia.

*Sympiezoscetus norfolcensis* Lea (23). Genus recorded from Australia and New Zealand.

## COSSONINÆ.

*Pentarthrum millingtoni* Oll. (2). A widespread genus, especially in Southern Hemisphere, with a number of species in New Zealand, but apparently few in Australia.

*P. nepeanianum* Oll. (2). From Nepean Island, half a mile from Norfolk Island proper.

\**Phlæophaeosoma* sp. ? 70 ex. in dead wood of *Lagunaria patersoni* G. Don., 250 ft., 4. v. Genus recorded from British India, Japan, Java, Samoa, Hawaii, New Zealand (several species), Kermadec and Chatham Islands.

*Notiosomus insularis* Lea (20). Also recorded from Lord Howe Island. Australian genus; also Samoa.

**Scolytidæ (=Ipidæ).**

\**Pachycotes peregrinus* Chap. 2 ex. at light in house, 300 ft., 12. ii. and 4. v. Also recorded from New Zealand. =*Hylastes peregrinus* Chap., 1873, Syn. Scol. 229 (*Hylurgops*)=(?) *Pachycotes ventralis* Sharp, 1877, Ent. mo. Mag. xiv. 10 (teste Dr. K. G. Blair).

**Cerambycidæ.**

**PRIONINÆ.**

?\**Cacodacnus hebridanus* J. Thoms. (as *Toxentes rasilis* Oll.) (2 and 2 a). 1 ♂ at light in Pine Avenue, 300 ft., 25. i.; 1 ♀ in gully, 200 ft., 3. ii.; 1 ♂ at light in house, 300 ft., 27. iii. Also recorded from New Caledonia and New Hebrides. Genus also in Queensland and Victoria.

**CERAMBYCINÆ.**

*Ceresium flavipes* F. (as *simplex* Gyll.) (2). Also recorded from Lord Howe Island, Australia, New Zealand, Malay Archipelago, East Indies, Philippines, New Guinea, Mauritius, Madagascar and Mexico.

\**Diotimana* (as *Diotima*) *undulata* Pasc. 4 ♀♀ in house, 300 ft., 14. i.; 1 ♀ under dead log, 250 ft., 22. iv.; 1 ♂ (no details), 250 ft., 21. iv. The generic name used for this species hitherto has been *Diotima* Pasc., 1859, but unfortunately this is pre-occupied by *Diotima* Reichenbach, 1854 (Aves). The coleopterous genus therefore requires a new name, and I now propose the name *Diotimana*, nom. nov., in place of *Diotima* Pasc., 1859.

Also recorded from Queensland.

**LAMIINÆ.**

*Xyloteles pattersoni* Oll. (2) and *X. selwyni* Oll. (2). New Zealand genus; also Lord Howe Island, New Caledonia and Fiji.

\**Xyloteles*, 4 spp. (not of Olliff). 1 ex. in dead wood of *Lagunaria patersoni* G. Don., 250 ft., 4. v.; 2 ex. at light in house, 300 ft., 8. vi.; 2 ex. in house, 250 ft., 21. vi.; 1 ex. beaten from bushes, 250 ft., 29. vi.; 1 ex.

on *Maranta arundinacea* L., 300 ft., 5. vii.; 1 ex. in house, 300 ft., 6. x.; and 1 ex. (no details), 300 ft., 15. x.!

\**Enicodes fichteli* Schreib. (2). 1 ♀ (no details), 300 ft., 16. iii.; 1 ♀ on tree-trunk, Mt. Pitt, 950 ft., 4. viii.; 2 ♂♂, 1 ♀ in house, 300 ft., 3. x. New Caledonian genus and species; genus also represented in Loyalty Islands.

\**Enicodes* sp. 1 ♀ (?) on trunk of *Araucaria excelsa* Br., 250 ft., 16. v.

*Dysthæta nœmia* Oll. (2). Genus also in Queensland.

*Zygocera norfolkensis* McKeown (27). Australian genus; also represented in New Guinea.

### Chrysomelidæ.

#### EUMOLPINÆ.

\**Eucolaspis brunnea* F. (? = *Colaspis* sp. of Olliff (2)). 1 ex. in shed, 300 ft., 3. x. A New Zealand species and genus.

#### HALTICINÆ.

*Sphærophyma armipes* Lea (15). Genus also recorded from Queensland and Samoa.

*Psylliodes lubricata* Blackb., var. *norfolkensis* Lea (18). A nearly cosmopolitan genus, but not in South America.

The above list includes some 94 species (the exact figure is unavoidably uncertain owing to the indeterminata), as compared with the 27 species recorded by Olliff (2), and it is hoped it will prove of particular value to future students of this fauna by bringing together (with the appropriate references) a considerable number of scattered records, some of which are not readily to be traced. The majority of the identifications of Mrs. McComish's Coleoptera have been worked out by Dr. K. G. Blair, but Sir Guy Marshall and Mr. G. J. Arrow have assisted with their special groups. Mrs. McComish's material has provided six new records for the island, and contains, in addition, some 22 other species which it has been impossible, under present circumstances, to identify. While it is, of course, very probable that some of these indeterminata do, in fact, belong to known species, it seems almost certain that others are really new, e. g. the Carabid, *Dicrochile* sp., and the Gyrinid, but I feel that it is unsafe to assume this as a fact with a view to describing and naming them as new until further study under more favourable conditions has confirmed it.

## SPECIES OF ECONOMIC IMPORTANCE.

Although few of the Coleoptera included in the above list seem to have been actually recorded as of economic importance themselves, several of them, especially among the indeterminata, belong to genera which have received considerable attention in various parts of the world, and may therefore well repay careful watching, and in this respect the following notes may be of assistance :—

## Cucujidæ.

*Læmophlæus norfolcensis* Lea. Several species of this genus (sometimes under the name of a subgenus, *e. g.* *Cryptolestes*) have been recorded as pests of granaries, warehouses and stored products (Cacao, Maize, Flour, Rice, Cotton, etc.).

## Coccinellidæ

*Scymnus* and *Chilomenes* spp. Beneficial species which feed, either in the larval or imaginal stages, or in both, on Citrus and other Aphids and scale insects and may quite possibly feed on the Cottony-cushion Scale; which appears to be common in the island.

## Bostrychidæ.

*Xylion* (*Rhizopertha*) sp., allied to *X. (R.) collaris* Er. *X. (R.) collaris* Er., "The Apple-Tree Borer Beetle." *X. (R.) dominica* F., "Lesser Grain Borer" or "Australian Wheat Weevil" and *X. cylindricum* Macleay, which damages wine-casks, have all been recorded as more or less serious pests.

## Anobiidæ.

*Calymmaderus pulverulens* Lea. *C. capucinus* Sol. has been recorded in Chile as damaging oak furniture.

*Dorcatoma norfolcensis* Lea and *rhizobioides* Lea. Species of this genus have been recorded as damaging timber, books and papers.

## Elateridæ.

*Conoderus striatus* Macleay and spp. Species of this genus (frequently called *Monocrepidius*) have been recorded from various parts of the world as injurious to Cotton, Tobacco, Maize, Wheat, Beans, Sugar-cane, etc., while a few are regarded as advantageous owing to their larvæ preying upon injurious insects in the ground.

## Eucnemidæ.

*Fornax norfolcensis* Lea. Members of this family are timber beetles and may do considerable damage.

## Tenebrionidæ.

*Gonocephalum insulanum* Oll. Species of this genus (often referred to as *Hopatrum* or *Opatrum* spp.) have been recorded as injurious to Sugar-cane, Tobacco, Coffee, Tea, Wheat, Maize, etc.

*Gnathocerus cornutus* F., "Broad-Horned Flour Beetle," a cosmopolitan pest of Flour, Meal and other grain.

## Curculionidæ.

*Listroderes obliquus* Gyll. "The Brown Vegetable Weevil" or "Australian Tomato Weevil" (called in some of the records *L. costirostris* Schön. or *Desiantha novica(-us)* Lea) is a serious and widespread pest of vegetables and tobacco.

## Cerambycidæ.

*Ceresium flavipes* F. (*simplex* Gyll.) is a widespread pest on *Casuarina* trees (She-Oaks, Beefwood, etc.).

## Chrysomelidæ.

*Colaspis* sp. Many species of this genus have been recorded as pests of crops, fruit, etc., in various parts of the world.

*Psylliodes lubricata* Blackb. belongs to a widespread genus containing a number of serious pests of Cruciferæ, Potatoes, etc.

## DIPTERA.

A relatively large number of Diptera were obtained by Mrs. McCornish, but these included a quantity of specimens of the common and widespread *Culex fatigans*, Wied. (determined by the late Dr. F. W. Edwards), of which a sample only was mounted. Even so, the collection comprised 383 mounted specimens. Dr. John Smart informs me that the following families are represented in the collection :—

Nematocera :—Tipulidæ, Anisopidæ, Culicidæ, Chironomidæ, Psychodidæ.

Brachycera :—Asilidæ, Dolichopodidæ ;

Cyclorrhapha :—Syrphidæ, Calliphoridæ, Chloropidæ, Drosophilidæ, Lauxanidæ, Sepsidæ ;

but that " it is not practicable at the present time to make any specific determinations of the material in the collection, especially as the condition of quite a number of the specimens is poor."

It is hoped, however, that it will be possible to work out much of the material and publish a detailed account as a separate paper in the not too far distant future.

## HEMIPTERA.

Except for the Coccidæ and a small number of Aphids, which have been dealt with by Mr. F. Laing, and five Aleyrodids which could not be dealt with in the absence of the early stages, Mrs. McCormish's specimens of this order have been worked out, so far as possible under present conditions, by Mr. W. E. China, and comprised 77 specimens belonging to 8 families, 12 genera and 13 species.

The following is a copy of Mr. China's report :—

### Pentatomidæ.

- 1 *Nezara viridula* (L.). var. *chlorocephala* Westw. Cosmopolitan. Genus cosmopolitan, especially Africa.
- 2 *Dictyotus cænosus* (Westw.). E. Australia ; Tasmania ; New Zealand. Genus Australasian.
- 3 *Cuspicona* sp. (probably new). Distribution of genus : Malay Archipelago, Australia, Philippines, New Caledonia. Genus Austro-Oriental.

### Lygæidæ.

- 4 *Nysius* sp. near *clevelandensis* Evans. An Australian species. Genus cosmopolitan.
- 5 *Lethæus* sp. near *aurantiacus* Dist. A New Caledonian species. Genus cosmopolitan.

### Reduviidæ.

- 6 *Empicoris* (*Ploiariola* auct.) *rubromaculata* Blackb. Cosmopolitan.



## Capsidæ.

- 7 *Lygus* sp., probably new. No particular affinities ; runs down to near the cosmopolitan *L. apicalis* Fieb., but quite distinct. Genus cosmopolitan.
- 8 *Campylomma* sp. No particular affinities. Genus cosmopolitan.

## Veliidæ.

- 9 *Microvelia* sp., near *oceanica* Dist. New Caledonia and Loyalty Island. Genus cosmopolitan.
- 10 *Microvelia* sp.

## Delphacidæ.

- 11 *Delphacodes* sp., female indeterminable. Species separated on ♂ genitalia. Genus cosmopolitan.

## Ricaniidæ.

- 12 *Scolypopa* sp., probably new, near *australis* Wlk. An Australian species. Genus in Australia, Madagascar and Africa.

## Jassidæ.

- 13 *Orosius* sp. near *albicinctus* Dist. A South Indian species.

Mr. China adds, in an accompanying letter :—" It is impossible under present conditions of scattered libraries to identify the species not in the British Museum."

Out of 13 species he says that :—

	Serial No. of Species in List.
2 are cosmopolitan species.	1 & 6
1 is a widely distributed Australian species.	2
1 belongs to an Austro-Oriental genus with many species in Australia ; probably a new species.	3
1 to a genus common to Australia, Africa and Madagascar (an unusual distribution) ; probably a new species.	12
1 to a South Indian genus probably occurring throughout the Austro - Oriental Region ; probably a new species.	13
6 ( <i>sic</i> : it should be 7) belong to 5 ( <i>sic</i> : it should be 6) cosmopolitan genera, and that all are probably new.	4, 5, 7, 8 9, 10 & 11

### Tingidæ.

In addition to the above, *Teleonemia lantanæ* Dist. has been introduced to Norfolk Island as a control against the weed *Lantana camara* L. (= *aculeata* L.).

### Cicadidæ.

Distant (34) records *Melampsalta convicta* Dist., also from Norfolk Island.

### Aphididæ.

These are in very bad condition. They were taken from leaves of Orange-trees and proved to be *Aphis gossypii* Glov. This is a cosmopolitan species found on a wide range of food-plants, of which Orange is one.

### Coccidæ.

These comprised 53 specimens, and the following list has been prepared from identifications and information supplied by Mr. F. Laing :—

Species.		Host plant.
<i>Icerya purchasi</i> Mask. ("The Cottony-cushion Scale"). . .	20 specimens.	<i>Acalypha</i> shrub.
<i>Icerya purchasi</i> Mask ("The Cottony-cushion Scale"). . .	12	Lucerne.
<i>Pseudococcus</i> belonging to the <i>longispinus</i> group, and probably that species.	7	On flowers of a small shrub.
<i>Saissetia coffeæ</i> (Wlk.) . . . . .	2	<i>Gomphocarpus physocarpus</i> (E. Mey.).
1. <i>Saissetia</i> sp., probably <i>coffææ</i> (Wlk.) . . . . .	2	} <i>Olea europæa</i> L.
2. <i>Coccus</i> (v. young) ? <i>hesperidum</i> L. . . . .	5	

All are cosmopolitan within their climatic range, and have probably been introduced to the island with cultivated plants, upon which some at least may prove to be serious pests unless prompt measures are taken to control them.

### Aleyrodidæ (=Aleurodidæ).

Also, as mentioned above, there were five specimens belonging to this family, collected from underpart of leaves of *Solanum auriculatum* Ait. Aleyrodidæ ("Mealy Wings" or "White Flies") are all potentially dangerous, and many are very serious pests of plants and fruit.

## SPECIES OF ECONOMIC IMPORTANCE.

Besides the Tingidæ, Aphididæ, Coccidæ and Aleyrodidæ, referred to above, the following species mentioned in Mr. China's list have been recorded as of economic consequence or are closely related to species so recorded :—

*Nezara viridula* L. ("The Tomato and Bean Bug" or "The Southern Green Plant Bug") is an important pest of Peas, Maize, Wheat, Tomato, Beans, Potato, Sweet Potato, Turnip, Cotton, etc.

*Dictyotes cænosus* Westw. has been recorded in New Zealand as injurious to Fodder-grass, Lucerne, Red Clover and Blackberries, and is stated to over-winter at the base of leaves of *Juncus effusus*.

*Cuspicoma* sp. *C. simplex* and *C. thoracica*, pests of Potatoes and other ground and field crops.

*Nysius* sp. Species of this genus, which include "The False Chinch Bug" and "The Rutherglen Bug," have been recorded as serious pests of Tobacco, Cruciferae, Sugar Beet, Vines, Wheat, Tomato, Strawberries, Potatoes, Peaches, etc.

*Empicoris* (*Ploiariola* auct.) *rubromaculata* Blackb. Allied *E. variolosus* L. has been recorded as a pest of *Hevea brasiliensis* in British Guiana, attacking young shoots, causing exudation of latex.

*Lygus* sp. Species of this genus, which include "The Tarnished Plant Bug" and "False Tarnished Plant Bug," have been noted as serious pests of Apples, Pears, Peaches, the greenhouse generally, Potato foliage, Cabbage, Beet, Mangels, Onions, etc.

*Delphacodes* sp. *Delphacodes sordescens* Motch. is known as a pest of Rice in Java, and many close allies have been recorded (under the names *Liburnia* or *Delphax*) as serious pests of various crops.

*Scolypopa* sp. *S. australis* Wlk. has been noted in New Zealand as injurious to Apple-trees, and in Australia as damaging Passion Vines.

*Orosius* sp. Although no actual records of damage caused or induced by members of this genus have been found, a considerable number of species of the Jassid family have been noted as vectors of various virus diseases of plants, apart from the direct damage they cause to leaves and fruit by their feeding habits.

### THYSANOPTERA.

Mrs. McComish collected considerable numbers of specimens of this order from a faded bloom of *Hibiscus insularis* Endlicher, a flower-stalk of *Rhopalostylis baueri* H. Wendl. & D., etc. Unfortunately their condition is too bad to allow of identification. Previously Karny (35) had described and recorded one species, *Phlæothrips leai*, from the island.

### PSOCOPTERA.

Mrs. McComish's collection contained 13 examples of this order, but Mr. D. E. Kimmins, who kindly undertook the task of trying to identify them, has found it impossible in present conditions to do more than arrive at genera. His list is as follows :—

*Peripsocus* sp., 5 specimens.

*Cæcilius*, 4 species, 5 specimens.

*Lepinotus* sp., 2 specimens.

Lepidosocidæ, 1 specimen in bad condition.

### NEUROPTERA and ODONATA.

The Neuroptera (4 specimens) and Odonata (38 specimens) collected by Mrs. McComish have been fully dealt with by Mr. D. E. Kimmins (36) in a recent paper.

#### List of Species.

Odonata.—Corduliidæ : *Hemicordulia australiæ* (Rambur) \*. Cænagriidæ : *Ischnura aurora* (Brauer) ; *Agriocnemis exsudans* Selys \* ; *A. vitiensis* Tillyard \*.

Neuroptera.—Hemerobiidæ : *Drepanacra binocula*, var. *insularis* Tillyard and var. *norfolkensis* Tillyard ; *Carobius pulchellus* Banks ; *Eumicromus tasmanicæ* (Walker) †. Chrysopidæ : *Synthochrysa lutea* (Walker) \* ; *Chrysopa anomala* Tillyard ; *C. metastigma* Tillyard ; *C. nautarum* Tillyard ; *C. leai* Tillyard ; *C. araucariæ* Tillyard † ; *C. waitei* Tillyard ; *C. norfolkensis* Tillyard.

### DERMAPTERA.

There were 33 specimens of Dermaptera among Mrs. McComish's material, probably belonging to two

\* Collected by Mrs. I. McComish, and new to Norfolk Island list.

† Collected by Mrs. I. McComish.

species, but no determinations are possible at present. One species may be the *Anisolabis xenia* described by Kirby (37) from Norfolk Island and said by him to be allied to *A. littorea* White from New Zealand.

### ORTHOPTERA.

Mrs. McComish obtained 56 examples of this order, including a small number of Tettigoniidæ and Gryllidæ and at least two species of Blattidæ, of which unfortunately, however, present conditions prevent the determination.

### COLLEMBOLA.

Mrs. McComish also collected a few individuals of this Order, including some Podurids, but here again no definite identifications have been possible owing to the condition of the specimens.

### THYSANURA.

There were a few specimens of this Order in Mrs. McComish's collection, but all were in poor condition, with most of the appendages lost or broken and scales rubbed off, and so far it has not been possible to determine any of them with certainty. One or two, however, appear to belong to the family Lepismatidæ.

### GENERAL NOTES ON THE FAUNISTIC RELATIONSHIPS.

Several of the papers mentioned in the bibliography below have dealt, more or less incidentally, with the relationships of the fauna of this island. Besides these, however, reference may be made to papers by Capt. F. W. Hutton, F.R.S. (29, which also gives a certain amount of bibliography), R. J. Tillyard, F.R.S. (30), and by Dr. Karl Holdhaus (32). Obviously the truly endemic fauna has been greatly supplemented by introductions from abroad through the importation of various plants and the spread of cultivation (these would include many of the phytophagous species of economic importance), partly with general merchandise and supplies for the islanders (these would include most of the widely distributed grain and warehouse pests), and partly in other ways (including, perhaps, ova carried on the feet of birds, casual carriage by ships, etc.). It appears, that the

island was used as a penal station by New South Wales and Tasmania till 1855; then in 1856 the mutineers of the 'Bounty' were transferred to Norfolk Island from Pitcairn Island; and in 1865 it became the headquarters of the Melanesian Mission founded by Bishop Pattison. Although, therefore, the geographical situation of the island is much nearer to New Zealand than to Australia it seems probable that much of the sea-borne traffic of the earlier days of settlement was with Australia and Tasmania, though later (1856 onwards) no doubt it was otherwise. Bearing this in mind, it seems to me necessary to be very careful, in drawing inferences from the present fauna, to exclude all species which could have been artificially introduced at a time when little notice was taken of such matters, whether they might have been brought from the Australian or New Zealand regions. In spite of this, and although there are still so many indeterminata, it does appear that in the main (there are apparently certain exceptions, *e. g.* in the Formicoidea and in the Trichoptera) the insect fauna of the island shows more affinity with that of North-eastern and Eastern Australia than with New Zealand, though there is undoubtedly some connection with the latter also.

In conclusion I can only express my regret that the determinations of Mrs. McComish's material could not be more complete, especially as several of the orders obtained by her appear never to have been recorded from the island before.

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LXXI.—*The Beginning of the Teleostean Fishes.* By  
Sir ARTHUR SMITH WOODWARD, F.R.S.

IN 1901 (4) I enumerated some of the principal changes in the skeleton of the bony fishes which appeared for the first time during the Cretaceous period—changes which made possible the comparatively great diversity observable among the Teleostei of the Tertiary period and the present day. The skeletal characters thus introduced are indeed restricted to the Teleostei in the existing fauna. It may therefore be inferred that the Cretaceous fishes in which they are found belong to the Teleostean grade, which is usually defined from that of the Ganoids by three characters in the soft parts, of which only one can be observed among fossils, and that very rarely.

The most important changes occurred in the cranium itself (3). In the Jurassic Ganoids, the otic region is never prominent and does not project laterally beyond the roof-bones, while the supra-occipital bone is either unossified or small, and is always covered by the superficial plates. The roof-bones form a plane surface, without crests and rarely show any depression even in the middle. The earliest Teleosteans exhibit a tendency to the lateral projection of the otic region beyond the superficial bones of the cranial roof, besides having the supra-occipital bone exposed, and this new arrangement characterises the large majority of the Teleosteans which have subsequently appeared. The roof of the skull for the first time begins to exhibit bony crests to accommodate either forward extensions of the superficial muscles or deposits of mucus connected with the sensory apparatus. An upstanding median longitudinal crest on the supra-occipital bone becomes especially large in fishes which have the trunk deeper than the head.

There are also new developments in the jaws. In the Jurassic Ganoids the pre-maxilla and maxilla always share the tooth-bearing border of the upper jaw ; and when there is a powerful dentition on the vomer this is always opposed to a corresponding dentition on the splenial bones of the lower jaw. In a large proportion of the Teleostei, the pre-maxilla forms the whole of the tooth-bearing border of the upper jaw excluding the maxilla, which remains above it as a toothless bone ; and when there is a powerful dentition on the base of the skull it is usually not on the vomer, but on the parasphenoid, and it is then opposed to a corresponding dental plate on the front of the hyoid arch.

It should also be added that in the Jurassic Ganoids the head and opercular bones are always smooth or merely rugose and tuberculated, while in the Teleosteans some of the head and opercular bones are often serrated or even provided with sharp spines.

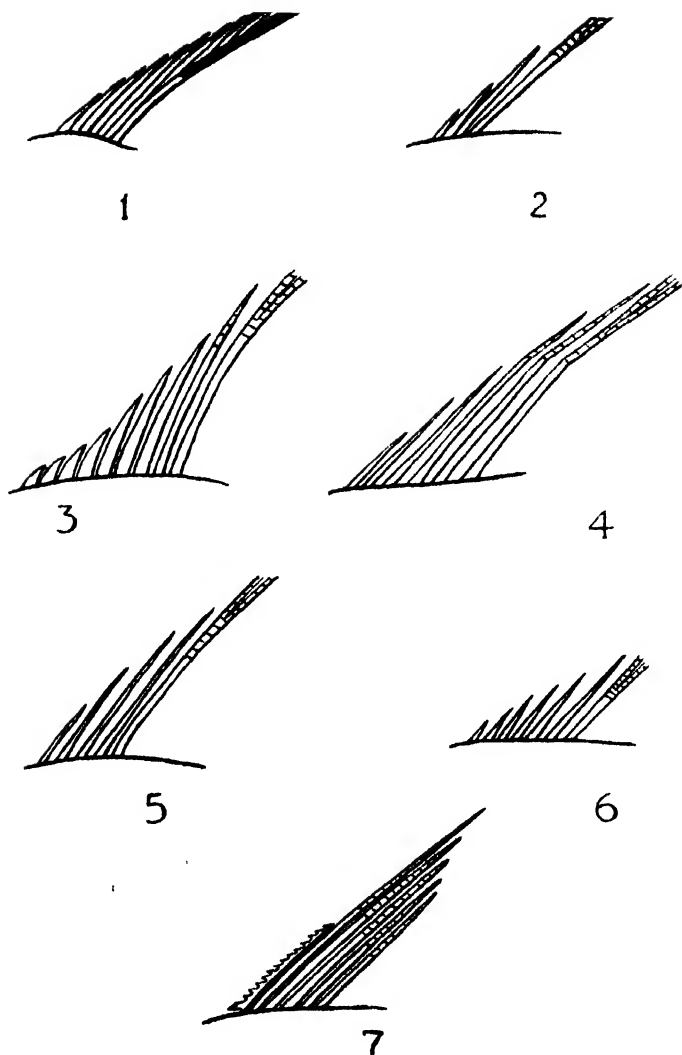
When the body is much deepened in the Jurassic Ganoids, the number of vertebræ usually remains much the same as in the more fusiform types. In the Cretaceous and later Teleosteans, on the other hand, when the body is much deepened, the vertebræ become comparatively few, and in certain families the number of vertebræ is remarkably constant. The only deep-bodied Ganoid hitherto



described in which there is a considerable reduction in the number of vertebræ is the Upper Cretaceous Pycnodont *Coccodus* (8), where the total number in the abdominal region is nine, and in the caudal region to the base of the caudal fin also nine.

In the Jurassic Ganoids the hæmal arches which directly support the caudal fin are never fused together : even when the caudal fin is so powerful that it needs a supporting plate, as in the Pachycormidæ, this is provided by the fan-shaped expansion of a single hæmal spine. In the Cretaceous and later Teleosteans the hæmal spines supporting the caudal fin are always more or less fused and modified in various ways.

In the Jurassic Ganoids the front edge of the fin is usually fringed by a series of small pointed scales termed fulcræ, and there is always a stout cluster of these scales at the base to strengthen the insertion of the fin (fig. 1). Even when the fringing fulcræ have disappeared, as in the Jurassic Leptolepidæ (fig. 2), the basal fulcræ remain crowded together and progressively increasing in length still to strengthen the insertion of the fin. In the more generalised Teleosteans, both of the Cretaceous and later periods, these basal fulcræ persist in much the same form, or are variously reduced. In most groups of Teleosteans however, the basal fulcræ often assume a much greater functional importance and, even in the Upper Cretaceous fishes, they already show a very varied development. In the dorsal fin of the Ctenothrissidæ (fig. 5), for example, the basal fulcræ are well spaced and each is modified into a slender fin-ray, which is articulated in its distal portion. These simple anterior rays, though all much longer than ordinary basal fulcræ, still increase progressively in length backwards, but the last does not quite equal in length the foremost divided ray of the fin itself. Their simplicity compared with that of the ordinary fin-ray is easily explained. Each basal fulcrum consists of one scale or a pair of scales fused together ; each ordinary fin-ray (lepidotrich) was originally a composite structure consisting of a cluster of longitudinal fibres flanked on each side by a row of small scales (2). In *Ctenothrissa* (fig. 5) the number of anterior simple rays is four and the foremost divided ray of the fin itself is slightly shorter than the second fin-ray, which is the longest. In *Pateroperca*



Some modifications of the fulcrum, with foremost fin-ray, in the dorsal fin of Jurassic Ganoids and Cretaceous Teleostean.

Fig. 1.—*Lepidotus* ; basal and fringing fulcrum.

Fig. 2.—*Leptolepis* ; three basal fulcrum.

Fig. 3.—*Platyormus* ; seven spines and one simple ray which is articulated distally.

Fig. 4.—*Pateroperca* ; three spines and two simple rays which are articulated distally, all spaced.

Fig. 5.—*Ctenothrissa* ; four spaced simple rays which are articulated distally.

Fig. 6.—*Hoplopteryx* ; six spaced stout spines.

Fig. 7.—*Pharmaciothys* ; basal fulcrum reduced to one barbed spine, the five anterior fin-rays spinous at the base, but articulated (filamentous) distally.

(fig. 4) there are five modified basal fulcra which are similarly spaced, and only the fourth and fifth or longest have become slender rays with an articulated distal end; the foremost three are well-developed spines which progressively increase in length. In *Platycormus* (fig. 3) only the hindmost and longest basal fulcrum is modified into a simple fin-ray with an articulated distal end, the other basal fulcra remaining as seven short spines, which progressively increase in length. These spines are more numerous than the basal fulcra in any known Jurassic Ganoid. In the typical *Hoplopteryx* (fig. 6) of the English Chalk, the same basal fulcra are modified into six spaced stout spines, which progressively increase in length as usual. In some other Cretaceous Berycoids the dorsal fin-spines are more numerous, and suggest that some may be modified ordinary fin-rays. That the ordinary fin-rays may become transformed into spines is shown by the Upper Cretaceous *Pharmacichthys* (fig. 7), where a cluster of five are incompletely developed.

Among the Upper Cretaceous and later Teleostean fishes, one or more of the simple slender rays which represent basal fulcra are sometimes much elongated to form tactile organs, especially when the fishes live in the deep sea. The elongated tactile filaments in the Teleostean fishes, indeed, seem to be usually modifications of basal fulcra, not of fin-rays. They are well seen in the Upper Cretaceous Scopeloid *Nematonotus* and in the Tertiary and Recent Acanthopterygian *Mene*. The only elongated fin-ray hitherto observed in a Jurassic Ganoid is in the pectoral fin of *Saurostomus* from the Upper Lias (7) \*.

\* It is interesting to note that the long persistence of the basal fulcra in their original function, and their final rapid and varied development, are paralleled in the history of the tail among four-footed land vertebrates. The tail remained a direct continuation of the body until the appearance of the mammals, and was used primarily in quadrupedal locomotion or in balancing for bipedal locomotion, only secondarily as a battering weapon or lash as in the Sauropodous Dinosaurs and Lizards. Even among Mammals it was little changed in such primitive groups as the Marsupials and the *Orycteropus*-like Ungulates. Very soon, however, the tail was modified into a well-separated small appendage with many adaptations. In some groups, such as the American monkeys, it became prehensile; in others, such as cats and dogs, it began to express the emotions; in others, such as the hoofed animals, it was adapted for removing flies from the sensitive skin; in a few others, such as the fat-tailed sheep of the East, it served as a reserve for nutriment; while in the beaver the remarkably flattened tail is said to be used as a gong on water to attract the notice of its fellows.

In the Jurassic Ganoids the pelvic fins are always far back from the pectoral arch; in the Cretaceous and later Teleosteans they are often displaced forwards so that the pelvic arch is in contact with the pectoral arch, especially when there is some spiny armature on the head or opercular bones. This forward displacement of the pelvic arch has hitherto been observed in only one Ganoid, the Triassic *Cœlacanth Laugia* from East Greenland.

In the Jurassic Ganoids the caudal fin is always present; in the Upper Cretaceous Teleosteans it is also usually present, but at least two genera are known (*Echidnocephalus*, *Pronotacanthus*) in which the caudal fin is either extremely reduced or absent and the body tapers to a point behind. This tail-less condition is not uncommon among Tertiary and Recent Teleosteans.

In the Jurassic Ganoids the scales, even when cycloid and deeply overlapping, bear a thin layer of ganoiné or tubercles of ganoiné on their exposed portion; this ganoiné, however, is sometimes destroyed during fossilisation. In the Cretaceous Teleosteans the continuous layer of ganoiné has disappeared.

It may be added that the first evidence of a distensible stomach in the bony fishes is seen in the Upper Cretaceous Dercetidae (5, 8) from Mount Lebanon. The first evidence of luminous organs on the body seems to be afforded by the peculiarly enlarged scales of the lateral line in the Upper Cretaceous genus *Echidnocephalus* from Westphalia. At least, these scales are very similar to those bearing luminous organs in the closely allied *Halosauropsis* from existing deep seas.

Some of these new characters are known to have appeared at the beginning of the Cretaceous period, and there is no doubt that during the earlier half of this period all of them arose in various groups of the evolving Teleosteans. Unfortunately, however, very few fossil fishes have hitherto been found in Lower Cretaceous formations. In an estuarine deposit of this age on the coast of Brazil, near Bahia, there are remains of fishes very similar to *Cheirocentrus* (*Cheiromystus*) and *Clupea* (*Diplomyctus*) and in a corresponding deposit at Ilhéos, also in the State of Bahia, there seems to be an ally of the Upper Cretaceous Clupeoid, *Scombroclupea*. In a marine Neocomian formation in the Voirons, Switzerland, there is also a *Cheirocentrid* (*Spathodactylus*) associated with a *Clupea*-like fish

and another Clupeoid (*Crossognathus*) which is round-bodied and lacks the ventral scutes. In a second marine Neocomian formation, the Hilsthon of Hanover, Germany, a Clupeoid fish resembling *Crossognathus* is also abundant. In no known Lower Cretaceous deposit has any Acanthopterygian so far been discovered.

In all marine Upper Cretaceous formations Teleostean fishes not only predominate, but are already very varied. Good specimens are known from the fissile limestones of Mount Lebanon, Syria, from a calcareous sandstone in Westphalia, from the English Chalk, and from the Chalk of Kansas, U.S.A., while fragments from India, Africa, South America, and Australia, show that such fishes had a wide geographical distribution. They belong to many distinct groups and it is difficult to believe that in so short a time as the Lower Cretaceous period all could have arisen from a common ancestral Teleostean stock. The facts are more reasonably explained by supposing that the several groups arose independently from approximately similar groups of the Jurassic Ganoids.

The earliest Teleosteans which most nearly approach the Ganoids are the Clupeoids and related families. The Cheirocentrids, for example, so closely resemble the Leptolepid Ganoid *Thrissops* that it is often difficult to distinguish them among the imperfect fossils. The Lower Cretaceous *Crossognathus* shows enough resemblance to other Leptolepid Ganoids to suggest that it also may have descended from this group. The skeleton of the Elopidae, Albulidae and the Osteoglossid-like Plethodontidae are only a little more advanced and may likewise have originated from the same source. The Upper Cretaceous Ctenothrissidae again might be a modification of some of the Leptolepid or Pholidophorid Ganoids, only changed by the forward displacement of the pelvic fins, the development of some basal fulcra into simple articulated fin-rays, and the advanced squamation. That some of the Clupeoids may have been derived from the Jurassic Pholidophoridae is suggested by the earliest known species of *Diplomystus*, the *D. longicostatus* from the Lower Cretaceous of Bahia, Brazil. The ventral and dorsal ridge-scutes of this species are evidently a direct inheritance from some Ganoid. Although most of the ventral scutes resemble those of the later species of *Diplomystus*, *Clupea* and related genera,

those behind the pelvic fins are expanded into plates which are rather like rhombic ganoid scales. A similar expansion is observed in the ventral scutes of the Lower Cretaceous Clupeoid *Scombroclupeoides* \* from Ilhéos, Brazil. As no ridge-scales are known among the Leptolepidæ, and as they are sometimes found among the Pholidophoridæ, the latter appear to be the most likely ancestors. *Archæomæne*, a Pholidophorid from the Jurassic of Australia, is worthy of comparison.

Another group of Teleosteans of which the skeleton is in many respects very primitive is that of the Ostariophysii. Unfortunately, however, most of these are freshwater fishes and they are unknown among fossils until the Eocene Tertiary. The Jurassic or Lower Cretaceous *Lycoptera* bears some superficial resemblance to a generalised Ostariophysid. By definition it is one of the Leptolepids, but according to T. D. A. Cockerell (1) its scales differ from those of other members of this family and are very similar to those of the existing Cyprinid *Phoxinus*. Here again, therefore, there is a suggestion of a link between the Jurassic Ganoids and another Teleostean group, the Ostariophysii. The varied fate of the basal fulcra of the fins in this group is interesting. In certain Cyprinids the basal fulcra of the dorsal and anal fins are modified into three or four spines, of which the hindmost is longest, stoutest and serrated on the hinder border. In many Siluroids the basal fulcra are reduced in number, only one remaining as a large serrated spine, though that of the dorsal fin has a short rudiment of a spine in front.

The Apodes or Eels are already well differentiated among the Upper Cretaceous fishes, they merely retain as ancestral characters a separate caudal fin, which is rounded, and occasionally (*Anguillavus*) the rudiments of a pair of pelvic fins which are diminutive (8). There is no definitive indication of the group of Jurassic Ganoids from which they were derived, but it has been noted that the scales of the modern *Anguilla* bear much resemblance to those of the Macrosemiid *Enchelyolepis* (6).

\* The small Clupeoid from the Lower Cretaceous of Ilhéos, Brazil, which I named *Scombroclupea scutata*, is evidently a close ally of *Scombroclupea*, but it may best be referred to a distinct genus to be called *Scombroclupeoides*. It is separated from *Scombroclupea* by its expanded ventral ridge-scales, of which seven behind the anal fin are in spaced series.

The other elongated Upper Cretaceous fishes of the families Dercetidae, Halosauridae, and Notacanthidae exhibit no special resemblance to any known Jurassic Ganoids, and in the absence of allies among the Lower Cretaceous fishes their relationship cannot even be surmised.

The rapacious fishes of the family Enchodontidae might well be derived from some Jurassic Ganoids of the family Eugnathidae. Like these fishes they have the most powerful dentition on the inner arch of the upper jaw, while their premaxilla tends to become antero-posteriorly extended. They have lost the regular covering of rhombic Ganoid scales, but a single row persists along the lateral line and there are often two or three ridge-scutes on the back behind the head. A pair of large post-cleithral plates also sometimes remains on the hinder edge of the pectoral arch. The Enchodontidae seem to be related to the contemporary primitive Scopelidae (Myctophidae), which are numerous in the Upper Cretaceous fauna.

The Acanthopterygian Teleosteans are remarkable for the varied and sometimes extreme development of the basal fulcra of the dorsal, anal and pelvic fins. As already mentioned, no Lower Cretaceous links between these Teleosteans and the Jurassic Ganoids have hitherto been discovered. There are also no gradations between them and the less specialised physostomous Teleosteans. It may, however, be observed that among the Jurassic Ganoids the family of Semionotidae exhibits unusually strong basal fulcra in the dorsal and anal fins. Some of these Ganoids, such as *Lepidotus*, are also noteworthy for the strong fixation of the premaxilla, which is articulated with the skull by an anterior ascending process, and in later species is extended to form the greater part of the tooth-bearing edge of the upper jaw. The maxilla in this case becomes a comparatively thin lamina of bone of which not more than the anterior half bears teeth. It is possible, therefore, that future discoveries may show some connection between the Cretaceous Acanthopterygians and the Jurassic *Lepidotus*-like Ganoids. One Upper Cretaceous Acanthopterygian at least, the deep-bodied *Aipichthys*, retains a series of abdominal ventral ridge-scutes which seems to have been inherited from a rhombic scaled fish. Most of the Upper Cretaceous Acanthopterygians belong to the

Berycoids and allied families, which are recognised among existing fishes as the most primitive members of their group. In some of these fishes, such as *Pycnosterinx*, the basal fulcra of the dorsal and anal fins are still pressed together and not much modified. In one genus, *Platycormus* (fig. 3), the last fulcrum only has changed into a long, simple fin-ray which is articulated in its distal portion. In *Hoplopteryx* (fig. 6) the basal fulcra of the dorsal and anal fins have become powerful spines, which are a little spaced. In some other Upper Cretaceous Berycoids the fin-spines are more numerous, and may result either from an increase in the number of the basal fulcra or by the modification of some of the anterior fin-rays into spines. That the dorsal spines in the Acanthopterygians do originate from these two sources is shown by the Upper Cretaceous genus *Pharmacichthys* (fig. 7), in which the basal fulcra are represented by a single barbed spine and the foremost five rays of the fin are spinous in their basal half though retaining a divided portion distally (the so-called filament). *Pharmacichthys* is not a Berycoid, but seems to be ancestral to another series of Acanthopterygians, the Chaetodonts and Balistids. A still more advanced Acanthopterygian type is the Upper Cretaceous Percoid *Pateroperca* (fig. 4). This has a primitive dorsal fin in which the first three basal fulcra are short stout spines, while the following two fulcra have been modified into simple rays with an articulated distal portion. It will be noted that the simple articulated rays both in this fish and in *Platycormus* are similar to those which represent the basal fulcra in the Clupeoid Ctenothrissidæ. The occurrence of *Pateroperca* in a Cretaceous fauna shows that the existing deep sea elongated Percoids, such as *Lopholatilus*, are more likely to be primitive than degenerate forms. The unique Upper Cretaceous *Protobrama* (8) from Mount Lebanon belongs to another Acanthopterygian series, which apparently ends in the Bramidæ of to-day. It displays well the degenerate remains of Ganoid flank-scales which are observed in the existing fishes of this family. The Upper Cretaceous Acanthopterygians therefore fore-shadowed the diversity which they were destined eventually to attain.

From these considerations it is evident that no further progress can be made in studying the early evolution of the



Teleosteans until large series of well-preserved fossil fishes have been discovered in Lower Cretaceous formations. It can only be said that the changes in the alimentary canal, heart, and optic nerves, which led to the coming of the Teleosteans, provided an impulse to very rapid and varied developments.

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[References to previous literature are given in these books and papers.]

LXXII.—*Descriptions and Records of Bees*.—CLXXXVIII.

By T. D. A. COCKERELL, University of Colorado.

*Nomia albicauda* Cockerell.

Uganda : Nagunga (C. C. Gowdey).

*Nomia alicæ* Cockerell.

S. W. Africa : Okahandja, 1928 (Turner). Also a variety of this, or possibly of *N. megacantha*, from the same place, having no red spot on mesonotum.

*Nomia anomala* (Kirby).

Kibwezi : (Dr. Van Someren).

*Nomia alternata*, sp. n.

I have a series of perplexing forms from Nyasaland, which may be separated and compared with some others, as follows :—

Females.....	1.	
Males.....	4.	
1. Hind tibiae clear red, basitarsi black ; stigma light red ; apical cloud of wings strongly defined.....		<i>perornata</i> Ckll.
Hind tibiae not thus red ; wings with no distinct apical cloud.....	2.	
2. Hind basitarsi long ; first tergite with a narrow but very distinct reddish apical band ; basal nervure nearly straight except at lower end, where it is curved.....		<i>rufosignata</i> Ckll.
Hind basitarsi short and broad ; first tergite without such a band ; basal nervure arched.....	3.	
3. Bands on tergites 2 to 4 broad and fulvescent. Bands on tergites 2 to 4 narrow and whitish.....		<i>fulvohirta</i> Smith.
4. Hind femora black, their tibiae and tarsi entirely yellow.....		<i>natalensis</i> Ckll.
Hind tibiae at least largely black.....	5.	
5. Apical part of hind femora, or at least apical margin, red.....	6.	
Hind femora black.....	8.	
6. Second and following tergites densely covered with pale hair.....		<i>heterocera</i> Ckll.
Tergite not so covered, but with bands.....	7.	
7. Apical cloud of wings very distinct ; flagellum dark.....		<i>orientalis</i> (Friese) (det. [Friese]).
Apical cloud of wings evanescent ; flagellum red beneath.....		<i>heterura</i> Ckll.
8. Flagellum dark ; first tergite with no band (Katanga).....		<i>capensis</i> (Friese).
Flagellum bright red beneath.....	9.	
9. Larger : middle femora largely red.....		<i>rufosignata</i> Ckll.
Smaller : middle femora black.....		<i>flavitaris</i> Friese.

In matching the sexes, I have been guided by a small but apparently important character of the venation. In *N. alternata* the lower section of the basal nervure is regularly and conspicuously arched, but in *N. rufosignata* it is long and practically straight, except at the lower end, where it is abruptly bent. The sexes are in complete agreement in respect to this character. *N. natalensis*, *flavitaris* and *orientalis* show the arched type ; *N. capensis* and *heterura* are somewhat intermediate. In all these bees the second submarginal cell receives the recurrent nervure very near the end, except in *N. orientalis* and *N. heterura*, in which it is not so near the end.

A related species is *N. fulvipes* Friese, which (male) has the following characters :—length about 9 mm., anterior wing 7·7; black, with the tibiæ and tarsi light yellow; face broad, with dense slightly flavescent hair; mandibles dark; vertex broad and dull; hair of thorax dull whitish, short and scanty dorsally; mesonotum polished and strongly punctured; scutellum binodose; area of metathorax a narrow band, crossed by plicæ; posterior face of metathorax shining, exposed; tegulæ red, not enlarged, with a pallid lobe in front; wings hyaline, with a distinct apical cloud; stigma large, very pale yellow; basal nervure straight except lower end, falling a little short of nervulus; second submarginal cell very broad, receiving recurrent nervure not far from end; third submarginal very broad on marginal; hind femora robust, but not greatly swollen, with a tooth beneath; hind tibiæ broadened apically, but otherwise simple; abdomen moderately shining, finely punctured, first tergite very broad; tergites with rather narrow faintly fulvescent hair-bands, on first failing in middle; second sternite with a flattened, semi-circular light brown area. This description is based on a male from Bothaville, Orange Free State, sent by Friese.

*N. alternata*, sp. n., may be compared with *N. fulvipes*, but is distinct by the following characters :—length about 12 mm.; anterior wing 7·6; head longer, face narrower, but orbits less converging below; tongue very long and slender; flagellum very long, dark reddish beneath; thorax above with short dense fulvous hair; scutellum densely hairy; area of metathorax a narrow band, shining in middle, failing at sides; hind femora very hairy, much more robust than in *N. fulvipes*, but much less so than in *N. vulpina* Gerst.; hind tibiæ very broad; hind trochanters with a tubercle; no pale area on second sternite. The stigma is much smaller than in *N. fulvipes*. The yellow hind tibiæ contrast strongly with the black femora.

Nyasaland: Mlanje, Feb. 27, 1913 (*S. A. Neave*).

A female, taken by Neave at Mlanje, April 23, 1913, was at first referred to this species, but on more careful comparison was found to belong to *N. fulvohirta* Smith.

*Nomia interstitinervis auricauda* Cockerell.

S.W. Africa: Okahandja (*Turner*).

*Nomia brevistigma*, sp. n.

♀.—Length about 12 mm., anterior wing 9.

Robust, black, with the hind tibiae and basitarsi red (the basitarsi more or less blackened at end), but so densely hairy that the surface can hardly be seen; face broad, covered with dull white hair; mandibles faintly reddish in middle; flagellum short, bright red beneath; mesonotum and scutellum shining and strongly punctured on disc; area of metathorax a transverse band, crossed by ridges; posterior truncation with thin short hair; sides of thorax with dense, coarse, dull white hair, dorsum with thin pale greyish hair; scutellum swollen, with a median channel, but not bigibbous; tegulae elongate, dark brown; wings dusky, darker apically; stigma and nervures dark brown, the stigma very short and obtuse; basal nervure meeting nervulus; second submarginal cell broad, receiving recurrent nervure beyond the middle; hair on inner side of hind basitarsi bright orange, on outer side white; abdomen broad, moderately shining, rugosely punctured, the depressed margins of the tergites (which are more or less reddish) covered with white tomentum, on first tergite confined to the sides, on second failing in middle; hair at apex of abdomen red.

Nyasaland: Ruo Valley, 2000 ft., Dec. 14, 1913, three (*S. A. Neave*).

This belongs to a group of species with very small stigma; from *N. marginata* Friese it differs by the red hair at end of abdomen, and the dark stigma, tegulae and mandibles. From *N. montana* (Friese) it differs by the hair of thorax above not being fulvous, and the greater size. It is much larger than *N. viridarii* Ckll., which has a much longer stigma. In Strand's table it runs near the larger *N. sansibarica* Strand.

*Nomia chilwicola*, sp. n.

♀.—Length about 9 mm., anterior wing nearly 8.

So similar to *N. chiromensis* Ckll., that I took it for the same, but it is distinctly larger and more robust, and the mesonotum is shining, with distinct separated punctures, and the three impressed lines in front are very distinct. In *chiromensis* the mesonotum is dull, and not trilineate. Other characters of *N. chilwicola* are:—face broad, densely

covered with dull white hair; antennæ black; scutellum with abundant slightly fulvescent hair; metathorax hairy, the basal area broadly triangular, glistening, with coarse plicæ; tegulæ not enlarged, black; wings yellowish hyaline, not darkened at apex; second submarginal cell very broad, receiving recurrent nervure a little beyond middle; hind tibiæ and basitarsi very hairy, reddish, the basitarsi with a very large black area about the middle; abdomen with broad bands of dense fulvous tomentum, on third and fourth tergites narrowing laterally, on first, which is shining, very broad at sides, but failing in middle.

Nyasaland: S.W. of Lake Chilwa, Jan. 9 and 12. 1914, three (*S. A. Neave*).

This may perhaps be the female of *H. chiromensis*, though the wings are darker, and the impression one gets is of a distinct species.

*Nomia capensis* (Friese).

Nyasaland: Mlanje and S.W. of Lake Chilwa (*Neave*).

In *Ann. Mag. Nat. Hist.*, Sept. 1931, p. 279, I gave a table in which I tried to separate the various forms which have been confused under *N. tridentata* Smith. From the Katanga Mission, near Elizabethville, I have both sexes of a form in which the wings are hardly at all reddened, but have the outer margin broadly and conspicuously darkened. I have considered these to be *capensis*, but in respect to the wings they agree with the form *orientalis* Friese, as shown by a specimen received from Friese. A male form from Bogoro, Belgian Congo, July 10, 1914 (*M. Bequaert*), has similar wings. But males from Lubumbashi (*M. Bequaert*) vary, and some have strongly reddish wings, without the darkened border (agreeing with the *capensis* of my table). I cannot make out that they represent a different species.

*Nomia wellmani* Cockerell.

Belgian Congo: females taken by Michael Bequaert at Elizabethville and Lubumbashi, and by Joseph Bequaert at Bogoro, differ from the type by the distinctly red tegulæ, and perhaps represent a distinct race. The wings are dusky throughout, whereas in type *N. wellmani* the apical margin, beyond the cells, is broadly darkened.

*Nomia whitfieldi*, sp. n.

♂.—Length about 7 mm., anterior wing about 5.3.

Black, with bright ferruginous legs; head broad, eyes black, orbits converging below; mandibles pale reddish, dark and shining at end; face and front densely covered with pale, slightly yellowish hair; antennæ only moderately long, the flagellum dusky red beneath; mesonotum dull, feebly shining, with short hair only distinctly visible in lateral view, and a distinct border of pale tomentum all around, except at sides anteriorly; scutellum dull, simple, unarmed; postscutellum densely covered with dull white tomentum; metathorax tomentose, the bare basal area rugulose, forming a broad triangle; tegulæ not enlarged, pale reddish; wings hyaline, slightly dusky at apex; stigma large, red; nervures reddish, basal nervure rather strongly arched, falling a little short of nervulus; second submarginal cell very broad, receiving recurrent nervure a little beyond middle; hind femora robust, simple; hind tibiæ broadened at end, with a projecting point anteriorly; abdomen robust but not very broad, the first tergite seen from above showing about half a circle; abdomen moderately shining, the apical depressions of tergites pallid, forming conspicuous bands, which are tomentose at sides; apex with long hair; apical region beneath clear red.

Sudan: Talodi, Aug. 6, 1929, on cotton (*F. Whitfield*).

A distinct species, because of the clear red legs. In Strand's table it runs nearest to *N. zuala* Strand, but that differs in the colouration of legs and antennæ. In my tables it falls near *N. phenacopoda* Ckll., but the hind legs are quite different.

*Nomia tangensis* Cockerell.

Mombasa (*J. Bequaert*).

Includes the male, which is new. There is a conspicuous band of light hair before the scutellum, not present in *N. anomala*.

*Nomia tectula*, sp. n.

♂.—Length about 7.2 mm., anterior wing 5.7.

Black, with very light reddish tarsi, knees reddish, anterior tibiæ reddish in front on apical half, hind tibiæ reddish at extreme apex; mandibles black; face and front densely covered with pale yellowish hair; antennæ not

very long for a male, flagellum obscurely reddish beneath ; mesonotum, scutellum and postscutellum covered with fine fulvescent tomentum, partly denuded on mesonotum in one specimen ; scutellum obtusely bigibbous ; metathorax tomentose, the basal area small, the centre with a narrow bare line descending from the area (in *N. politibasis* with a broad band) ; tegulae rather large, fulvous, with a dark base ; wings ample, hyaline, slightly dusky, with no apical cloud ; stigma large, very pale yellowish ; nervures very pale ; basal nervure arched, meeting nervulus, second submarginal cell much higher than broad (very much broader in *N. politibasis*), receiving recurrent nervure a little beyond the middle ; legs simple and slender, hind tibiae stout at apex, but without a dentiform process ; abdomen highly polished, basal tergite broad, depressed hind margins of tergites pallid, covered with pale tomentum at sides ; fourth sternite bare.

Zanzibar : Nazi Moja, Oct.-Dec. 1924 (*H. J. Snell*).

There is a second specimen, which lacks abdomen. Very close to *N. politibasis* Ckll., but distinguished by the tomentum on upper surface of thorax, and the shape of the second submarginal cell. The mesonotum is dull, as in *N. politibasis*, not shining as in *N. ligata* Vachel. There is evident affinity with *N. aurifrons* Smith, from Sierra Leone, which has the flagellum red beneath, and is smaller.

*Nomia plebeia*, sp. n.

♂.—Length about 7 mm., anterior wing 6.7.

Moderately robust, with broad base of abdomen ; black, with the tarsi very pale reddish, front and middle knees reddish, but the hind knees hardly at all, the hind tibiae black to base ; face densely covered with faintly fulvescent hair ; antennae moderately long, black, the flagellum very faintly reddish beneath ; mesonotum and scutellum shining, thinly hairy, but a band of pale tomentum along hind border of mesonotum, resembling that on postscutellum ; scutellum elevated but not bigibbous ; metathorax hairy at sides, thinly so in middle, basal area a rather broad band, dull and finely rugose ; tegulae not enlarged, but pointed behind, rather pale brown ; wings long, hyaline, a little dusky, faintly clouded at end ; stigma large, dusky reddish ; nervures brown, basal nervure falling a little

short of nervulus ; second submarginal cell large, about square, receiving recurrent nervure in the middle ; hind legs very conspicuously hairy ; abdomen moderately shining, hind margins of tergites pallid and shining, covered with hair at sides ; fourth sternite with a large hairy patch.

Katanga : Elizabethville, May 13. 1920 (*Michael Bequaert*).

Very similar to a series of small black *Nomia*, separable (males) as follows :—

Flagellum clear red beneath ; stigma very pale (Sudan) . . . . .	<i>medani</i> Ckll.
Flagellum dark, or, if distinctly red beneath, stigma not pale . . . . .	1.
1. Anterior tibiae red ; no hair-band along hind margin of mesonotum (Zululand) . . . . .	<i>robustula</i> Ckll.
Anterior tibiae at least largely black . . . . .	2.
2. Robust ; mesonotum dull, a little shining on disc posteriorly (Aliwal North) . . . . .	<i>pulchella</i> Friese.
Mesonotum shining . . . . .	3.
3. Larger : wings with a dusky apical cloud . . . . .	<i>plebia</i> Ckll.
Smaller : wings with no such cloud (Lubumbashi) . . . . .	<i>humilis</i> Ckll.

*Nomia humilis*, sp. n.

♂.—Length 6 mm., anterior wing 5.2.

Black, with dusky brown stigma and very pale reddish tarsi. I had at first referred this to *N. plebeia*, but it is smaller, and differs thus :—wings much shorter, and with no trace of an apical cloud ; stigma much smaller, though not very small ; the shining scutellum conspicuously bigibbous, with a median groove ; flagellum red beneath ; tegulae smaller ; hind tibiae red at base, and narrowly at apex ; area of metathorax large and triangular ; hind margins of tergites darker.

Katanga : Lubumbashi, March 8, 1921 (*Michael Bequaert*).

There is no hair-band along hind margin of mesonotum, and the postscutellum is not conspicuously hairy. There is also one from Elizabethville, April 29 (*M. Bequaert*),



LXXIII.—*Jurassic Lycopod Megaspores from the Griesthorpe Plant Bed.* By MABEL KENDALL, University of Reading.

THE megaspores described here were isolated by Prof. T. M. Harris from fragments of Middle Estuarine (Upper Bajocian) shale belonging to the Edwards and Wonnacott Collections from the Yorkshire coast in the Geological Department of the British Museum. The shale was disintegrated by soaking in cold water, washed on wire gauze, dried, and the fossil plant material sorted in the dry state. Prof. Harris handed the specimens to me for description.

*Triletes sparassis* Murray. (Fig. 1.)

1939. *Triletes sparassis* Murray, p. 400, text-figs. 3–4.

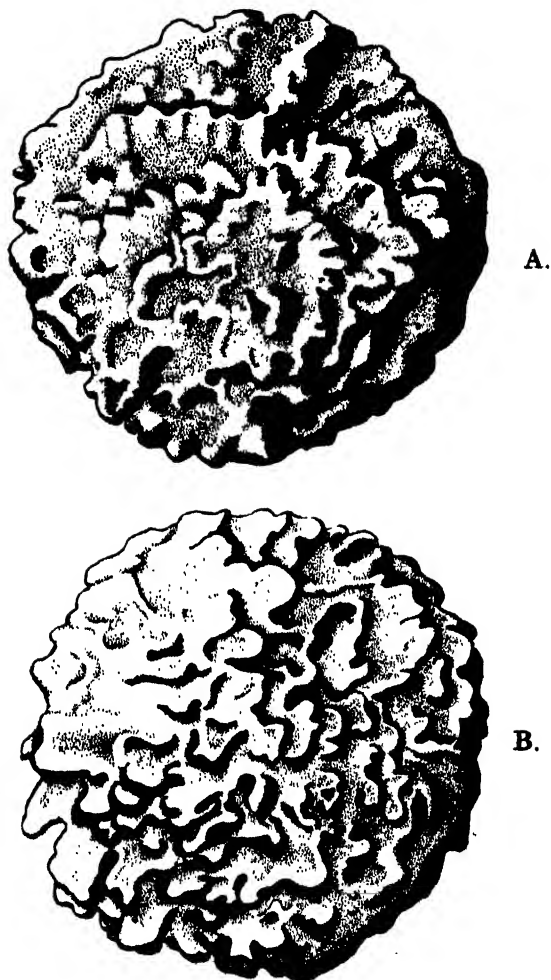
*Description.*—*T. sparassis* is represented by nine specimens. Their diameter varies from  $475\text{--}775\mu$ , the average being about  $590\mu$ ; several of the spores are oval instead of round. The trilete sutures are typically about  $240\mu$  long, and their lips, although prominent, are not very conspicuous among the ridges on the spore surface. Arcuate ridges are absent and the region of the facets is not distinguished, the whole surface bearing strongly-developed plates and ridges which bend and anastomose or end irregularly. These ridges are typically about  $50\mu$  high. By transmitted light, the wall appears to be composed of a single layer about  $30\mu$  thick, on the surface of which the plates spring. These plates are composed of a much thinner layer of cuticle. The whole substance of the spore-wall is composed of very minute granules.

In one abnormal specimen the ridges were less developed, being only  $8\mu$  high; in another they were normally developed on the distal surface, but smaller in the region where the facets should be.

*Discussion.*—The present specimens agree well with those described by Murray (1939); the characteristic ridges being exactly similar. The range of size is slightly greater than that given by Murray ( $390\text{--}580\mu$ ), but there is no reason to suppose that the average size is different. It is interesting to note that Murray's specimens came from the Midlands, and appreciably younger rocks (Upper

Estuarine, a stage of the Bathonian). This species may thus prove to be of widespread occurrence, and part at

Fig. 1.



*Triletes sparassia*; V. 26836.  $\times 100$ .

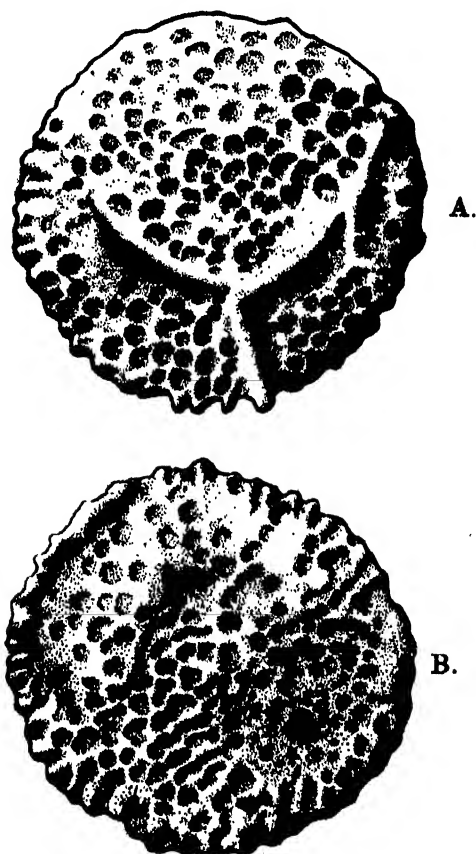
In A, the trilete ridges are seen near the top; B is the dorsal surface.

least of its time range is established. It may well prove to be a stratigraphically useful fossil.

*Triletes cyttaria*, sp. nov. (Fig. 2.)

**Diagnosis.**—Megaspore shape nearly spherical, diameter 410–500  $\mu$ . Trilete sutures typically 200  $\mu$  long, lips con-

Fig. 2.



*Triletes cyttaria*; V. 26839.  $\times 100$ .

Type-specimen. A, ventral surface; B, dorsal surface (slightly cracked at one point).

spicuous, about 22  $\mu$  wide. Arcuate ridges not present, facets not distinguished. Whole surface uniformly marked with shallow rounded polygonal pits separated by ridges about 10  $\mu$  wide. Surface of pits and also of ridges minutely rugose. In optical section wall apparently

composed of a single layer, about  $14\mu$  thick at the bottom of the pits,  $25\mu$  at the ridges between the pits. In profile, pit is saucer-shaped; the ridge between adjacent pits forms an angle of  $90^{\circ}$ – $110^{\circ}$ .

*Discussion and comparison.*—The specific name is from the fungus *Cyttaria*, which is similarly pitted. It is represented by four very similar specimens.

*T. cyttaria* belongs to a group of Mesozoic megaspores with pitted or reticulately thickened walls. The most similar of these is *T. rexargenteus* Harris (1935), a Rhætic spore, in which the size is, however, usually greater, the pits deeper and thus much more distinct by transmitted light, and the trilete lips relatively narrower. In *T. areolatus* Harris (Lower Liassic) an additional difference is that the ridges between the pits are narrower, and in *T. erlanssoni* (Miner) = *Selaginellites erlanssoni* Miner (1932), a Cretaceous megaspore, the ridges appear to be still narrower. The spores mentioned by Black (1929) differ in being much larger.

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LXXY ".—*A few new Species of the Scarabæid Subfamily Hybosorinæ (Coleoptera). with a Key to the Genus Phæochroops.* By GILBERT J. ARROW, F.Z.S., F.R.E.S. British Museum (Natural History).

SINCE the publication in 1912 of the Catalogue (Junk, Berlin) of this little group, compiled by myself, 30 additional species have been described in the same number of years. Five more Oriental species are added here, three of them collected in Borneo by Messrs. B. M. Hobby and A. W. Moore during the Oxford University Expedition in 1932, bringing the total for the subfamily to 142 species. A few of the catalogue names will probably be found to be synonyms.

*Phæochrous nanus*, sp. n.

Deep reddish chestnut, with the legs and lower surface yellow, the elytra sometimes dark brown; elongate-ovate, convex, the head and pronotum smooth and shining, the elytra closely punctured and scarcely shining. Clypeus broadly semicircular, coarsely granular or rugose, forehead irregularly punctured. Pronotum minutely and sparingly punctured, the sides gently rounded, not flattened nor fringed. Elytra closely and rather strongly punctured, without striæ or costæ, some of the punctures forming incomplete longitudinal series, the outer margins not flattened, fringed only with short scattered setæ. Front tibia bearing three strong lateral teeth and a few minute denticles.

Length 5-6 mm.

BENGAL: Chapra (*Mackenzie*).

BIHAR: Pusa (*T. Bainbrigge Fletcher*, June-August).  
Taken at light.

It is rather remarkable that, contrary to the usual proportions observed in the group, only three males were taken amongst over fifty specimens. The species is an unusually small one and peculiar for its irregularly punctured elytra and the similarity of the two sexes. The males are distinguishable only by the cleft claws. The Chinese *P. rufus* Pic, of the same small size, appears to be a related species. It is described as pale red in colour, with a punctured head, flattened margins to the pronotum and striate-punctate elytra.

*Phæochridius cinereicollis*, sp. n.

Black above and deep red beneath, the entire upper surface evenly and closely punctured, the head and pronotum deeply and very densely, producing a very dull appearance, the elytra bearing regular longitudinal rows of shallow umbilicate punctures and very shining. Body very convex, rather short, the pronotum rather narrow, the sides and base gently curved, the elytra strongly rounded at the sides and rapidly dilating from the base. Legs slender, the front tibia armed with three long sharp teeth placed rather close together.

Length 8 mm.; breadth 4.5 mm.

BORNEO, Sarawak: foot of Mt. Dulit, junction of rivers Tinjar and Lejok (Oxford University Expedition, September and October).

Specimens were taken in some number, attracted by carrion as well as by light. The species evidently resembles the Sumatran *P. derasus* Har., but differs from it in the absence of a longitudinal depression upon the pronotum. The sutural angles of the elytra are only feebly toothed and there is no smooth unpunctured area near the base in any of the specimens. (This feature appears to denote the female sex.) The dull surface of the densely punctured head and pronotum is in strong contrast with the shining elytra, which are very convex, rather short and strongly dilated behind. They are shorter than those of *P. haroldi* Fairm., which, like *P. uniformis* Arrow, is of a bronzy red colour. It is probable that *P. benderitteri* Pic is synonymous with the last, described three years previously from the same locality.

*Microphæochroops peninsularis*, sp. n.

Testaceous yellow beneath, dark brown above, with the anterior part of the head, the lateral margins of the pronotum and sometimes a narrow median longitudinal line, sometimes also the extremities of the elytra, yellow; the whole upper surface shining and, except upon the scutellum, rather evenly but not very closely punctured with large shallow circular pits, each bearing a long erect seta. Head a little hollowed in front, with a prominent ridge in front of each eye, the labrum narrowing to its front edge, where it bears a small erect tubercle, extremity of the mandibles with a long sharp inner tooth and a short outer one, the clypeus strongly punctured and straight in front. Pronotum about twice as wide at the base as its length, the sides almost straight, the front angles produced, the hind angles a little blunted. Scutellum long and narrow, with the apex rounded. Elytra very convex, dilating from the shoulders to past the middle and broadly rounded behind.

Length 4.5-5 mm.

MALAY PENINSULA, Perak: Jor Camp, 2,000 ft. (*E. Seimund*, August). Three specimens.

This species probably resembles the genotype, *M. hirsutus* Pic (Tonkin) rather closely. It is not *testaceus*, *supra medio brunnescens*, being very dark brownish black above, with the front of the head and the sides of the pronotum pale, nor are the scutellum subtriangular and the elytra densely punctured; but the brief description

affords little information as to the appearance of the Tonkin species, the only one hitherto known.

*Microphæochroops lætus*, sp. n.

Testaceous yellow, with the head, pronotum and legs dark red and the elytra black, with a bright yellow triangular basal area, its apex at the middle of the suture but its limits not sharply defined. The scutellum also is pale. Upper surface very convex, shining, with large but not very numerous round umbilicate punctures, absent from the base of the pronotum, each bearing an erect hair. Head elevated in the middle between the eyes and a little hollowed in front, narrowing sharply from the eyes forward. Labrum fused completely with the clypeus, very smooth, bearing a recurved tooth at the front margin. Pronotum about twice as wide at the base as its length, with the sides gently rounded, the front angles sharp and the hind angles blunt. Scutellum hollowed, punctured and very blunt. Elytra short, very convex, with wide flat outer margins.

Length 4 mm.

BORNEO, Sarawak: Mt. Dulit, 4,000 ft. (Oxford University Expedition, October). A single specimen was found in primitive forest.

In addition to its different coloration, *M. lætus* is rather smaller than *M. peninsularis*, more convex and more shining, the punctures upon the upper surface being less numerous. The head is almost smooth in front, the sides are less produced before the eyes, the labrum is not distinct from the clypeus and the mandibles are acutely incised and sharply bidentate. The sides of the pronotum are more rounded.

*Phæochroops punctulatus*, sp. n.

Brownish black, clothed with reddish hair and setæ; the sides of the prothorax and elytra and the tibiæ fringed with long stiff hairs. Body pyriform, convex, densely punctured above and not shining. Head and pronotum strongly and evenly punctured, the clypeus long, parallel-sided and rounded in front. Pronotum strongly transverse, broadest at the base, with the hind angles fairly sharp. Elytra densely covered with horseshoe-shaped punctures, the sutural margin and three discoidal costæ sharply elevated, the latter bearing numerous erect setæ.

Length 10-11 mm.; breadth 6-7 mm.

BORNEO, Sarawak: Matang (C. J. Brooks, July), Mt. Merinjak, 2,000 ft. (G. E. Bryant, May), Mt. Kalulong and foot of Mt. Dulit (Oxford University Expedition, November).

NORTH BORNEO: Kina Balu.

This species resembles *P. acuticollis* Arrow, also from Kina Balu, but is smaller and the puncturation of the upper surface is finer and less confused. The hairy clothing is closer and shorter and the elytral costæ, instead of a few isolated punctures each bearing a long erect hair, bear numerous punctures with close short hairs. The costæ are very sharp and distinct and the intervals very closely punctured.

It is perhaps not quite impossible that this is *P. gilleti* Bend., which, like it, was found at Matang. That is of similar size but is described as having the prothorax longer than wide, with its sides sinuate before the hind angles, and the elytra fringed only at the base. If the description is accurate it is unlike any other species of the genus.

I believe that I formerly attached undue importance to differences in the eyes, which led me to distinguish a species called *P. mentawaiensis*. I now regard that name as a synonym of *P. rattus*.

Types of most of the species of *Phæochroops* are in the British Museum, and the following key should prove useful for their identification. Four are unknown to me and are therefore omitted, viz., *P. lansbergei* Cand. (Java), *silphoides* Fairm. (Sumatra), *gilleti* Bend. (Sarawak), and *angulatus* Bend. (Palawan). It may ultimately be found that some of the forms can be best regarded as local races:—

- |   |                             |
|---|-----------------------------|
| 1 (16). Lateral margins of the elytra fringed with long hairs.            |                             |
| 2 (3). Puncturation of the pronotum extremely fine and dense. ....        | <i>opacicollis</i> Arrow.   |
| 3 (2). Puncturation of the pronotum not extremely fine.                   |                             |
| 4 (7). Puncturation of the pronotum rough and uneven.                     |                             |
| 5 (6). Elytra not densely punctured. ....                                 | <i>curtulus</i> Sohm.       |
| 6 (5). Elytra densely punctured. ....                                     | <i>acuticollis</i> Arrow.   |
| 7 (4). Puncturation of the pronotum regular.                              |                             |
| 8 (9). Pronotum rather narrow, its punctures coarse. ....                 | <i>indicus</i> Arrow.       |
| 9 (8). Pronotum broader and punctures finer.                              |                             |
| 10 (11). Upper surface dull; hind angles of the thorax rather sharp. .... | <i>punctulatus</i> , sp. n. |
| 11 (10). Upper surface less dull; hind angles of the thorax very blunt.   |                             |



- |   |                            |
|---|----------------------------|
| 12 (13). Head rugosely punctured.....                                 | <i>peninsularis</i> Arrow. |
| 13 (12). Head separately punctured.                                   |                            |
| 14 (15). Thorax densely punctured.....                                | <i>vulpecula</i> Arrow.    |
| 15 (14). Thorax not densely punctured, its<br>median line smooth..... | <i>gigas</i> Arrow.        |
| 16 (1). Lateral margins of the elytra without<br>hair-fringes.        |                            |
| 17 (18). Elytral costae strongly elevated.....                        | <i>recticollis</i> Pic.    |
| 18 (17). Elytral costae rather feebly elevated.                       |                            |
| 19 (20). Lateral margins of the thorax rounded..                      | <i>niasianus</i> Arrow.    |
| 20 (19). Lateral margins of the thorax straight.                      |                            |
| 21 (22). Larger.....  | <i>rattus</i> Arrow.       |
| 22 (21). Very small.....  | <i>batusensis</i> Arrow.   |

The minute Sumatran insect, *Pantolasius vethi* Lansb., seems to be related to *Phæochroops* but, according to the description, has a broad scutellum and very prominent eyes. Schmidt, in Wytsman's 'Genera Insectorum,' part 150, has given non-serrate front tibiae as a distinguishing feature, but this is an error.

Another anomalous genus attributed to the Hybosorinae is *Brenskea* Reitter (1914), formed for *B. coronata* Reitt., inhabiting Turkestan and Persia. *Spermohybosorus testaceus* Pic (1922), found in North Africa, Egypt and Palestine, evidently belongs to this genus. Specimens compared by M. de Peyerimhoff with the type of *testaceus* were collected in Arabia. Nothing in Reitter's description is inapplicable to these and it seems likely that all belong to one wide-ranging species. *S. testaceus* has been figured in Mem. Soc. Hist. Nat. Afrique du Nord, 1931, pl. 3, fig. 10, apparently from a female example. In the males the five head-processes are longer than in the females.

## BIBLIOGRAPHICAL NOTICES.

*On Growth and Form.* By D'ARCY WENTWORTH THOMPSON.  
A New Edition. Pp. 1-1116, 2 plates, 554 text-figures.  
Cambridge: The University Press. Price 50s. net.

THIS is a very remarkable book. The first edition was published in 1917, during the war that we used to call the Great. It quickly went out of print, and for a long time now it has been marked as "rare" in secondhand book catalogues and valued at ten times its published price, a very uncommon fate for a modern scientific book. Now, amid the distractions of another and greater war, the veteran author has produced a

second edition, revised and enlarged by about half its original bulk. The reasons for the great and continuing interest in the book lie partly in the merits of the work itself and partly in its subject. Very few men of science have Sir D'Arcy Thompson's power of expounding a complicated and unfamiliar subject in plain and pellucid language (not without patches of the true imperial purple), and no man of our time, perhaps, can move with the same ease and assurance round the whole circle of the sciences. At a time when the younger biologists seem inclined to shirk the labour of acquainting themselves at first hand with the literature of their subject, his vast scholarship has provided a mine of references from which the least erudite can borrow at any rate the appearance of learning.

The subject of the book is the dependence of organic form on the interplay of physical forces acting within the lifetime of the individual organism, and its first publication came at a time when increasing attention was being paid to this "causal morphology" as distinguished from the "historical morphology" which was the almost exclusive study of the period that preceded it. Just how far such interpretations may carry us in considering the shapes of shells, the bee's honeycomb, the vertebrate skeleton and a hundred other organic forms, is demonstrated with admirable lucidity in this book, and many biologists will be surprised to find how far it is; but Sir D'Arcy Thompson is much too wise and much too experienced a naturalist to imagine that these interpretations will take us all the way. In the end "the two-fold problem of accumulated inheritance and of perfect structural adaptation confronts us once again and passes all our understanding." The dazzling discoveries of Mendelism and the facile explanations of Natural Selection seem only to lead us into blind alleys, and we are left face to face with the mystery of life itself.

In the new edition various sections of the book have been considerably extended. The chapter on Rate of Growth is twice as long as before, and such subjects as the form of the bee's cell, the radiolarian skeleton, the mechanical construction of a bird, and Galileo's principle of similitude are dealt with at greater length and with new illustrations.

The Cambridge Press deserves congratulations for having given this important work a worthy setting in spite of the restrictions of war-time economy.

W. T. C.

*Larvæ of Decapod Crustacea.* By ROBERT GURNEY. Pp. viii+306, 122 text-figures. London: The Ray Society (Bernard Quaritch, Ltd.), 1942. Price 25s. net.

IN 1939 Dr. Gurney published in the Ray Society series an indexed "Bibliography of the Larvæ of Decapod Crustacea." He has now given in this volume a summary of our knowledge of the subject and, in particular, of the additions made to it in the remarkable series of memoirs which he has published in the last twenty years.

Although the general course of the larval development of Decapods has been known for a long time, there are still remarkably few cases in which the whole series of stages is known for a single species. Dr. Gurney's researches have now made it possible, however, to define, with much greater precision, the main features of the series in a large number of genera throughout the principal families of the group. In the first part of the present volume he discusses the general questions suggested by the study of the larvæ, such as the bearing of the larval phases upon classification, pœcilogony, "giant larvæ" and the like. He then describes the changes that the external characters and the various appendages undergo in the course of the larval life. In the second part the families of Decapoda are taken in order and the types of larvæ characteristic of each are described. The text-figures, which are nearly all original, are admirably clear. There are many suggestions made by the author which deserve consideration from the point of view of the general zoologist. One such is the comparison between the Protozoæa stage, which, in one form or another, is found in nearly all Decapod life-histories, and the first Copepodid stage of the Copepoda. The suggestion that the characteristics of the Copepoda are "persistently larval rather than phylogenetically primitive" has often been made before (Beurlen's very superficial discussion, which Gurney quotes with approval, does not advance the subject very much), but the comparison with the Protozoæa will require to be considered in future speculations on the phylogeny of the group. Gurney's inclusion of the Euphausiacea in the Order Decapoda is certainly justified, although his grouping of the remaining Decapoda under the new name Eudecapoda is less happy.

This work has been issued in paper covers owing to war-time shortage of materials, but it is to be hoped that the disappearance of the familiar Ray Society binding is only temporary.

W. T. C.

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